AMATEUR RADIO

DECEMBER 1964

Vol. 32, No. 12

2/-

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OUR COVER

"Personally, I don't like it, but I reckon it would load up OK on 2."

FEDERAL COMMENT

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RETIREMENT AND AMATEUR RADIO

In this modern day and age, how many times are we asked "Have you made provision for your retirement?" Generally speaking, these enquiries are made by representatives of insurance companies anxious to sell us superannuation policies!

Finance is only one of the problems we must face when the time comes. One very important question which must be eventually tackled is how to spend all that time. Can you think of a more rewarding way of spending a large portion of that time than by the pursuit of Amateur Radio? Chatting away with friends all over the world—keeping abreast with life from the comfort of your own hearth? 'Tis then you will really appreciate the wonderful gift of friendship which Hamdom, with its lack of barriers, geographical, colour, creed or ideology, has to offer.

During the first flush of youth as an Amateur our enthusiasm runs to DX, Contests, Awards and late nights! A little later our greatest satisfaction is derived from the technical perfection of the home-built rig or the perfect aerial system. Then comes a time when the problem of providing for and raising a family dulls the interest in our hobby. Sooner or later the old urge reasserts itself and our excursions into Hamdom become more frequent with the emphasis on ragchewing, especially when our domestic responsibilities lessen.

Finally, comes the finest times of all—retirement—when we can achieve our greatest reward for a lifetime devoted to our hobby of Amateur Radio. We have all the time in the world at our disposal, have sound financial position and can then enjoy the pleasures which have never quite been satisfied before. At this time, in our twilight years, is perhaps the best time to give back something to Amateur Radio as well as take something from it.

This is the time when we can devote more time and energy to promoting better understanding and goodwill to our contemporaries in other countries, to cementing friendships born of casual contacts and in making new ones. This is an appropriate time of the year to be contemplating "peace and goodwill to all men", and in retirement we hope this sentiment carried down through the ages will be with you.

FEDERAL EXECUTIVE WISHES ALL AMATEURS A VERY HAPPY CHRISTMAS.

FEDERAL EXECUTIVE, W.I.A.

CONTENTS

Modifying F.M. Carphones for Multi-Channel Operation

J. W. SPICER, VK3ZEL*

THIS circuit is primarily intended as a guide to the conversion of the "old type" A.W.A. Carphone, which uses a 20-megacycle series type oscillator crystal, and the main object of the change is to bring these units into line with the later types of equipment.

This is achieved by re-wiring the oscillator chain and substituting a 10-megacycle parallel resonance crystal. At the same time provision is then made for switching to additional channels and providing individual frequency adjustment for each crystal.

When completed, the general circuit is similar to the later A.W.A. MR3A "Carphone Junior" circuit and the actual switching details may be adopted to convert these sets for multi-channel switching.

CONVERTING CARPHONE

To convert the old type Carphone, it is firstly necessary to re-wire the receiver oscillator chain in accordance with the circuit of Fig. 1. This involves the interchange of the existing 6J6 oscillator and multiplier with the 6AU6 tripler. In the re-arranged circuit, the 6AU6 becomes the oscillator and the 6J6 the doubler and tripler. It is suggested that some re-orientation of the sockets will be necessary for best wiring layout.

The circuit shows a second winding in the tripler coil can and this is an additional coil wound (with one turn less than the existing coil) loosely coupled to the existing single winding to also resonate at 120 Mc. (The slug in the original is removed.) If you feel so inclined a second winding in the oscillator plate coil will provide a means of increasing the spurious response rejection of the receiver (see insert diagram, Fig. 1), but several units have already been converted without this change and perform quite satisfactorily.

There is quite a fair amount of room in the Carphone receiver and space to house receiver and transmitter crystals and switch can probably be accommodated beside the receiver oscillator chain on a small sub-panel. The transmitter crystal oscillator circuit can be extended across to this point and a twisted pair is usually satisfactory for this purpose.

A similar arrangement to that suggested for the MR3A "Carphone Junior" would probably be quite adaptable for the "Carphone" (Fig. 2) and a general description of this is given below. However, any suitable arrangement could be used and remote relay switching would be quite adaptable to any of the units.

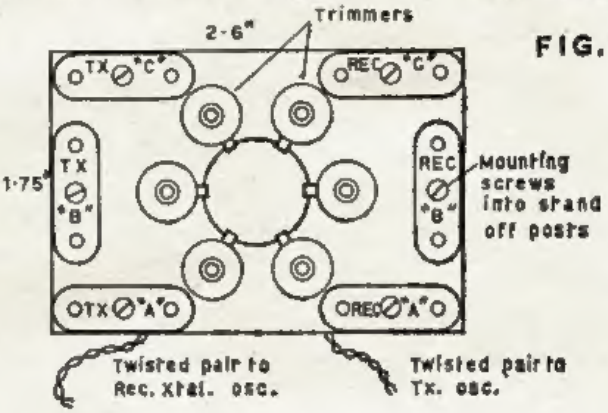
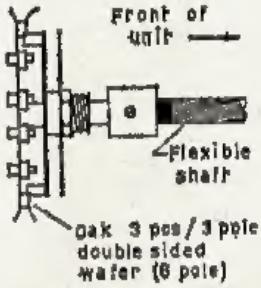


FIG. 2



SWITCHING IN THE "JUNIOR"

In the MR3A "Carphone Junior" multi-switching arrangements can be housed by mounting a small sub-panel above the microphone transformer. On this panel are mounted six "D" type crystal sockets and six of the improved Philips' trimmers (see Fig. 2). In front of this is mounted a double bank three-position three-pole wafer switch. This is housed in the space previously occupied by two electrolytic capacitors which are replaced with under-chassis pig-tail types.

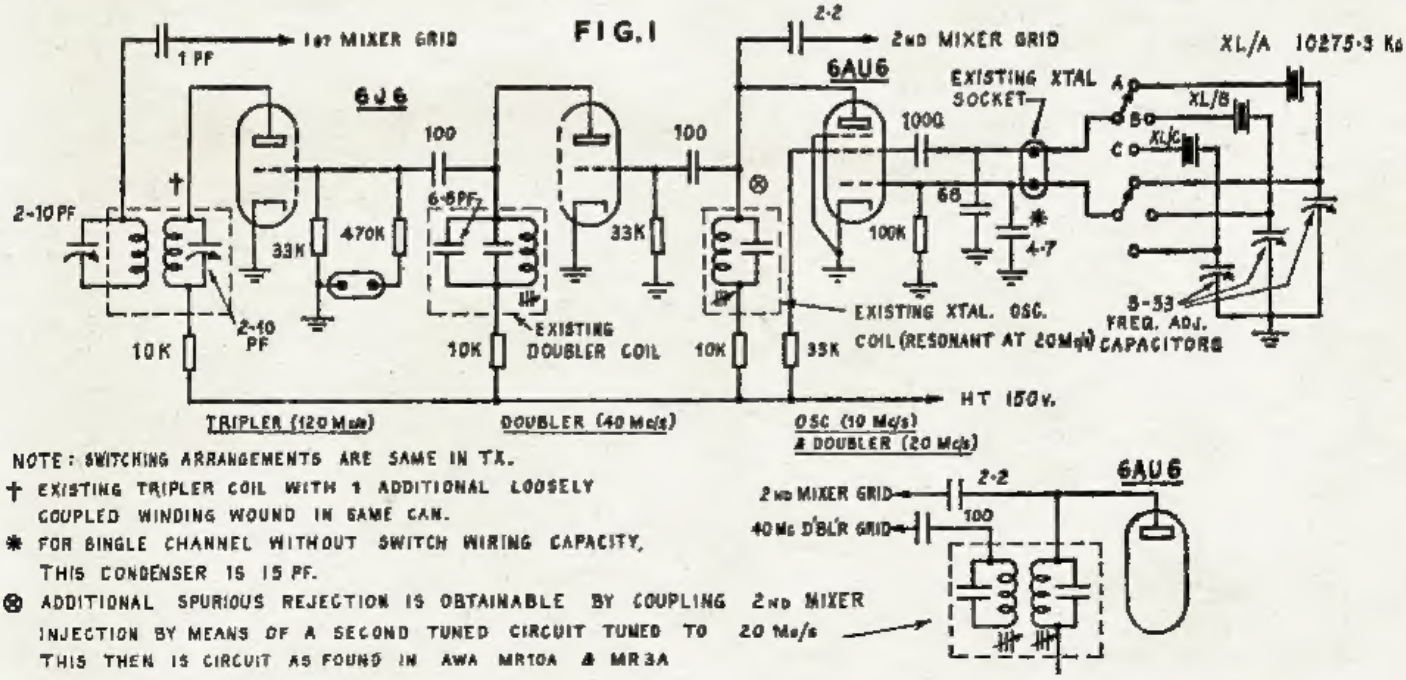
To help in wiring the sub-panel supporting the crystals and trimmers, a large cut-out hole (noval socket size) is made in the centre and the inter-wiring socket to trimmers, etc., passes through this.

A short flexible Bowden cable passes through a hole drilled in the "panel-lamp and switch bracket", and comes out at centre between the receiver and

(Continued on Page 16)

* 418 Stephensons Road, Mt. Waverley, Vic.

FIG. 1



USING THE OSCAR III. V.H.F. COMMUNICATION SATELLITE*

WILLIAM I. ORR, W6SAI

OSCAR III., the third in a series of space communication satellites designed and built by Radio Amateurs, is being tested in a pre-flight prototype package in preparation for a launch during the winter months of 1964. The Oscar III. satellite is a battery-powered high frequency translator[1] operating in the internationally assigned 2 metre band (144-146 Mc.) in accord with the new Amateur space allocation granted at the recent I.T.U. Space Communications Conference held in Geneva.[2]

In brief, the Oscar III. satellite permits two-way v.h.f. communication to be achieved by Radio Amateurs separated by the curvature of the earth (Fig. 1). The main portion of the transistorised equipment in the satellite listens to a 50 kc. segment of the 2 metre band centered about 144.1 Mc. and instantaneously translates this portion of the spectrum to a 50 kc. segment centered about 145.9 Mc., retransmitting the latter band segment to the ground observer. The satellite runs continuously, and an operational life of about one month is expected before the batteries expire. It is an aim of the Oscar Association eventually to launch a repeater of a similar nature with a higher orbit and longer operating life.

In addition to the wide-band translator, Oscar III. will incorporate two beacon transmitters. The first beacon will transmit on 145.85 Mc., and the signal will be the well known Oscar "HI" sent in Morse Code, followed by a burst of telemetering. Three separate measurements will be made within the satellite package and a simple system of pulse-width modulation will telemeter this information in sequence. The ground observer will be able to interpret the telemetered information with the aid of a 2 metre receiver and an inexpensive oscilloscope.

The second Oscar III. beacon will transmit a continuous unmodulated signal on 145.95 Mc. and will be useful for those experimenters wishing to make experiments requiring a phase-coherent signal. The two beacon signals will bracket the 50 kc. spectrum which contains the output from the translator (Fig. 2).

OPERATIONAL RANGE OF OSCAR III.

The operational range of Oscar III. depends, among other factors, upon the height of orbit above the earth. As this is unknown at the present time, it will be assumed to be about that of the earlier Oscar satellites (approximately 120 miles) until proved otherwise. Based on this figure and upon experience gained with Oscars I. and II., a radius of ground reception of the satellite turns out to be about 1,000 miles. Thus, two stations within 2,000 miles of each other are theoretically just within communication range via Oscar III. (Fig. 1B). At this distance, however, contact would be problematical, as the common communication area for both stations is extremely small.

Stations 800 miles apart or less, however, stand a much better chance of communication as the satellite remains within the common communication area for a greater length of time. Stations located along an east-west line, moreover, will generally have longer common communication time, as the Oscar III. satellite will probably have a north-south (polar) orbit.

The length of time the satellite remains within a common communications area between two stations depends upon the distance between the stations and the angle at which the satellite cuts across the area. For short distance contacts (stations separated by 500 miles or less, Fig. 1C) the satellite traverse time across the common communication area may be as much as six to eight minutes, whereas for extreme distances the traverse time may be a matter of only a few seconds.

USING OSCAR III.

Various types of experiments may be conducted by Radio Amateurs during the forthcoming flight of Oscar III. Passive, "listening experiments" are useful, as well as attempts to achieve two-way v.h.f. communication via satellite. In all cases, however, it is well to plan the operation in advance so that valuable time will not be lost during the period that the satellite is within radio range, estimated to be about eight minutes or less.

Telemetering Measurements: A more sophisticated form of telemetering is incorporated in Oscar III. than was used in the first two Amateur space satellites. The original Oscar beacon telemetered internal package temperature to earth by means of a temperature-sensitive element that varied the "HI" rate in such a way that a simple count of the rate by the ground observer could be translated into package tem-

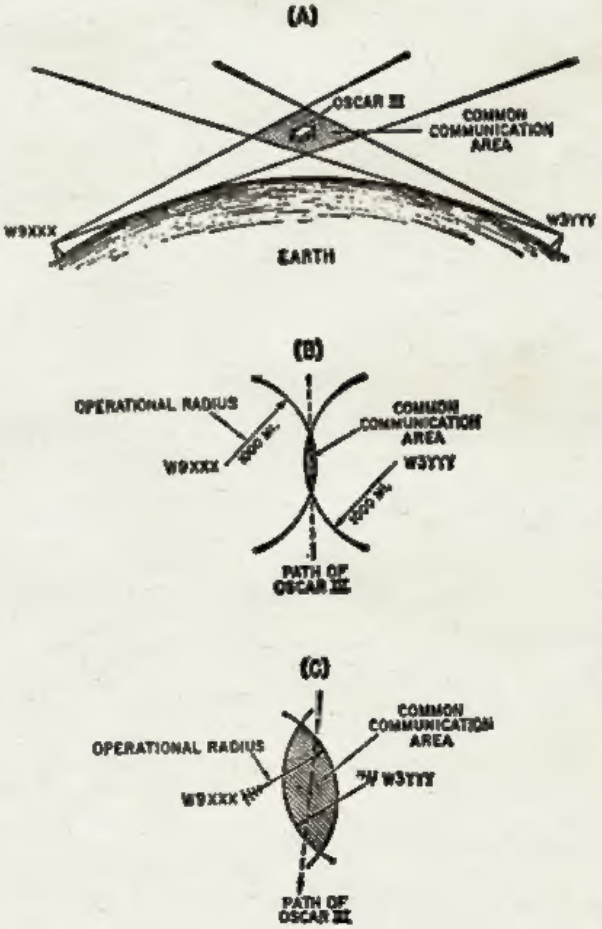


Fig. 1.

(A) A common communication area exists between two v.h.f. stations communicating via Oscar III. The area depends upon the distance between the two stations and the operational range of each station.

(B) Two v.h.f. stations within 2,000 miles of each other are theoretically able to communicate via Oscar III. if the satellite orbit is about 120 miles above the surface of the earth. At such extreme range, however, the satellite traverses the common communication area in a matter of a few seconds.

(C) As Oscar III. will probably have a north-south (polar) orbit, stations located on an east-west line will generally have a longer communication time than stations on a north-south line. The length of time Oscar III. remains in the common communication area depends upon the distance between the stations and the angle the satellite cuts across the area.

* Reprinted from "QST," August, 1964.

[1] Orr, "The Oscar III. V.h.f. Translator Satellite," "QST," February 1963.

[2] Jacobs, "Amateur Radio and the I.T.U. Space Communications Conference," "CQ," January 1964; "The Geneva Space Conference," "QST," January 1964.

perature. The "HI" rate of Oscar III. will be nearly constant and used only as an identifier, broken regularly by bursts of telemetering. The telemetering will consist of a series of pulses whose width will be a measure of the transmitted intelligence. Observing the ratio of pulse width to repetition rate on an inexpensive oscilloscope will provide temperature data. Several thermal points will be monitored within Oscar III. and the measurements will be transmitted in sequence, as will be described in a future article. The Oscar Association requests temperature measurement reports by interested Amateurs during the forthcoming flight.

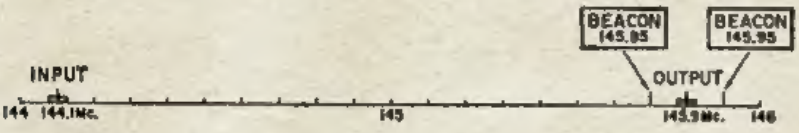


Fig. 2.—The 2 metre spectrum of Oscar III. The 50 kc. input band of the satellite is centered about 144.1 Mc. The corresponding output band is centered about 145.9 Mc. (inverted). Beacon transmitters are on 145.85 Mc. and 145.95 Mc., bracketing the output band.

Doppler Measurements: The 145.95 Mc. beacon may be used for Doppler data[2] by ground observers. The beacon emits a continuous, unmodulated signal, suitable for long-term measurements. It is hoped that some observers will maintain a 24-hour watch on this beacon, as various observations made on Oscar II. point to unusual modes of propagation that permit extremely long distance reception of the satellite, well beyond the usual line of sight. A continuously-running receiver coupled to a tape recorder may very well turn up a permanent record of long-distance reception by as-yet-unexplained modes of v.h.f. propagation. In addition, Doppler measurements may be made on this beacon to determine orbital parameters and predictions of future passes.

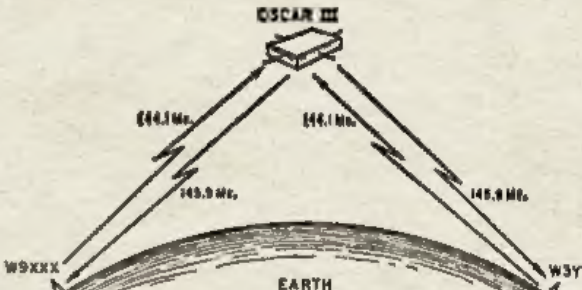
PASSBAND MONITORING

The translation equipment in Oscar III. will run continuously. When the satellite is in a quiescent state (no signals being received) the output of the translator consists of circuit and received noise, and may be readily identified by the ground observer as a hiss or "white noise" which covers the 50 kc. output frequency spectrum. The satellite may, in fact, be readily identified by this unique noise. When a v.h.f. signal of sufficient strength to activate the a.g.c. system of the satellite falls within its input passband, the output noise drops and the translated signal may be heard by a ground observer monitoring the output range of 145.875-145.925 Mc. As the satellite passes by, ground observers may tune back and forth across this range, logging signals within the passband that are repeated by Oscar III. Even though the observer possesses no transmitting equipment he will be capable of making a valuable contribution to the Oscar programme by monitoring the passband and logging all signals heard within the band. Copies of such logs should be sent to Project Oscar, Inc., Box 183, Sunnyvale, California, U.S.A.

It should be noted that signals passing through the translator portion of Oscar III. and received on earth will be subject to a Doppler shift occuring over two different paths. That is, the received signal will be a victim of Doppler shift as a result of the two-way transmission inherent in this system (Fig. 3). The translation circuitry of Oscar III. inverts the received signal so that the transmitted upper sideband of a ground transmitter will be repeated back as the lower sideband to a ground observer. This is done to reduce the combined Doppler shift to a value never greater than that observed by a simple one-way satellite-to-earth transmission.

It is possible, of course, that nearby ground-based signals occupying the satellite output frequency range may cause interference with the repeated satellite signals. It is hoped that Radio Amateurs will stay clear of the Oscar III. output frequencies during the pass time in a given location. Nontranslated earth signals in the output passband may be hard to identify although they will have no Doppler shift. Satellite-repeated signals generally will exhibit some degree of Doppler shift, but this may be less than the frequency shift commonly seen with many v.h.f. rigs using overworked surplus crystals!

Fig. 3.—Oscar III. translates a v.h.f. signal from 144.1 Mc. to 145.9 Mc. Signals may pass both ways simultaneously through the repeater, which operates continuously during the life of the battery. Oscar III. inverts the received signal so that the transmitted sidebands are reversed within the satellite, thus reducing the combined Doppler shift to a value never greater than that observed by a simple one-way satellite-to-earth transmission.



TWO-WAY SATELLITE COMMUNICATION

The primary purpose of Oscar III. is to permit two-way Radio Amateur translator satellite communication beyond the normal v.h.f. range. Maximum communication distance is limited by the orbital height of the satellite, which will be unknown until after launch, but it is hoped that transcontinental or transoceanic contacts may be had by well-prepared Radio Amateurs. Experiments conducted by Amateurs living in the San Francisco area with a preliminary Oscar III. model, mounted atop a tower at the home of W6VMH, proved that the satellite permitted satisfactory two-way communication provided the users knew what they were doing and co-ordinated their efforts. Many of the users of the earth-bound Oscar repeater during this preliminary test were Oscar Association members, well versed in the working of the equipment, yet the thrill of the moment and the excitement of using a spectrum repeater led to chaos, confusion and unwanted interference until some form of discipline was planned in advance and a method of use established.

It must be remembered that the output power of Oscar III., approximately one watt, will be shared by all the signals passing through the repeater. As more signals pass through Oscar III. at one time, a point will be reached where each signal commands such a small part of the available output power that none of the signals is usable by the ground observer. The output spectrum of the satellite then becomes a confused, mumbling mass of "garbage". This may be expected to occur within range of areas of heavy v.h.f. population during week-ends when many stations may try to use the repeater. At other times, only a few signals will pass through the repeater as it orbits over other areas of the world.

One suggested means of making optimum use of the Oscar III. repeater is to take advantage of the "buddy" system. This requires two Amateurs to act as a team, with a predetermined operation sequence, or "script". A joint effort will help to ensure that when Oscar III. appears over the radio horizon an attempt at two-way communication may be made under circumstances that will encourage success.

For illustration, let us assume a hypothetical pass of Oscar III. between two v.h.f. stations that desire to achieve two-way satellite communication. The problem is defined in this manner:

1. When does the satellite approach the proper position between the two stations, and how long will it remain within radio range of both stations?
2. What will be the line of position of the satellite between the stations at it moves along its orbital path?
3. What should be the transmitting frequency of each station, and to what frequency should each station receiver be tuned in order to hear the satellite-repeated signal of the other station?
4. At what critical times will each station listen and transmit?

It would be reasonable to assume, until proved otherwise, that calling

[2] Norgaard, "Eyeball and Eardrum Doppler Tracking," "QST," April 1962 and June 1962.

[3] Burhans and Rankins, "Keeping Track of Oscar," "QST," May 1962. Hilton, "Making Your Own Orbital Predictions from Doppler Measurements," "QST," March 1962.

CQ at random and "looking across the satellite band" for a contact would be asking too much; at least until the would-be satellite DXer has experience gained in a prearranged schedule with a reliable, not-too-distant v.h.f. companion. The greatest chance of success would seem to stem from a predetermined sequence of operation enacted between two co-ordinated "buddy stations" who have practised their modus operandi aided, perhaps, by pre-launch low-frequency co-ordination schedules or by mail.

The Oscar Association emphasises that Oscar III. experiments in two-way communication differ in one important respect from other v.h.f. communication experiments conducted in the past by Radio Amateurs. Previous long-distance communication efforts based on propagation anomalies depended heavily on chance or luck for success. If the atmospheric diffraction was right; if the microwave duct was established; if the signal scattering was effective; if the unknown mode of propagation worked—the fleeting two-way contact was established on a hit-or-miss basis. Hours (or years) of work, largely with unknown, random factors, contributed to success.

This heuristic (cut-and-try) philosophy is absent in Oscar III. If launch is successful and the satellite equipment functions properly, alert Radio Amateurs using the proper operating techniques and equipment at the proper time and frequency can achieve two-way repeater communication. Propagation anomalies have little to do with it; Oscar III. is a "go, no-go" bird and affords predictable success to those Amateurs using it in a knowledgable fashion. Communication via Oscar III. is not something you try, it is something you do!

The Oscar Association will do its utmost to provide accurate and up-to-date tracking information. In addition, v.h.f. Amateurs and clubs who tracked the earlier Oscar satellites are urged to generate and disseminate their own tracking information for local consumption.

A QSO VIA OSCAR III.

By way of example, let's eavesdrop on a hypothetical 2 metre QSO via Oscar III. Remember, one of these stations may be you! Our two heroes are W9XXX in central Illinois, and W3YYY in western Pennsylvania, situated about 500 miles apart, on an east-west path. Each station is equipped with a stable, low-noise 2 metre receiver, accurately calibrated in kilocycles across both the input and output ranges of the Oscar III. satellite. In addition, each station is equipped with an auxiliary "early-warning" receiver, tuned to 145.95 Mc., the c.w. beacon frequency, or to 145.85 Mc., the telemetry beacon frequency.[5] The receivers may consist of two v.h.f. crystal-controlled converters feeding a stable low-frequency communications receiver.

Each station is equipped with a 100-watt output crystal-controlled 2 metre transmitter, the frequency of which is known to a kilocycle. In addition, each station has a medium-gain Yagi antenna (5 elements, approximately 10 decibels) rotatable in azimuth only, controlled by a second operator whose job is to keep the beam antenna aimed on the satellite by virtue of the early-warning receiver tuned to a satellite beacon signal.

Information from the Oscar Communication Centre has notified our two DX-perts that the satellite will pass approximately between them, on a north-south path during the time period of 1400-1407 G.M.T. The tactical situation is shown in Fig. 1C. W9XXX aims his antenna to the east of north, and W3YYY aims his antennae to the west of north.

Both stations have agreed beforehand to transmit on 144,110 kc. plus or minus one kilocycle. They know that the Oscar III. translator will invert their signals and retransmit them back to earth on 145,890 kc., ten kilocycles lower than the centre frequency of the output range. Initially, it is decided that W9XXX will start transmitting when he first hears the beacon signal, while W3YYY will listen for W9XXX at the proper satellite repeated frequency of 145,890 kc. As a starter, therefore, the early-warning receiver of each station is tuned to the satellite beacon frequency of 145.85 Mc. and the communication receiver is tuned to 145,890 kc. As the fateful hour approaches when Oscar III. comes within range, the two stations quickly run through their individual "scripts":

1. Clock properly set to G.M.T.? Yes.
2. Communication receiver tuned to 145,890 kc.? Yes.
3. Early-warning receiver properly tuned to 145.85 Mc.? Yes.[6]
4. Antennae positioned in the proper direction? Yes.
5. It is known that Oscar III. will approach the common communication area at 1400 G.M.T. on each station's clock, and it is agreed that W9XXX will start transmitting as soon as he hears the beacon. Since he knows that W3YYY will hear the beacon at almost the same instant, he has decided to transmit for 30 seconds, then he will listen for one minute at 145,890 kc.

Each station is ready. The growing tension is broken by the second operator at W9XXX announcing he has heard and identified the c.w. beacon of the satellite! The tape recorder is started, and a few second later, reception of the beacon is verified at W3YYY. The time for the record-making QSO is at hand! According to the prearranged plan, W9XXX starts to transmit, calling W3YYY on 144,110 kc. with slow, steady c.w., one eye on the G.M.T. clock. Five hundred miles to the east, the second operator of W3YYY tracks the satellite beacon while the first operator tunes a few kilocycles above and below the repeater frequency of 145,890 kc. He hears the "white noise" of Oscar III., and carefully listens for the c.w. signal of W9XXX re-transmitted back to earth via the space craft! Success is almost at hand when he finally hears a portion of W9XXX's transmission, clearly audible above the "white noise".

When the 30 seconds are up, W9XXX signs over and starts to listen near 145,890 kc. for W3YYY, while the second operator at W9XXX faithfully continues to track the satellite beacon with the early-warning receiver, making any necessary adjustments to the beam antenna to hold the beacon signal at maximum strength. W3YYY is calling W9XXX on c.w., and shortly, the operators of the latter station are thrilled to hear the translator-repeated signal of W3YYY calling them close to 145,890 kc.! W3YYY passes a signal report to W9XXX and the QSO starts to resemble a normal low-frequency contact. Finally, during W9XXX's reply, both second operators note that the satellite beacon signal is going out of range, and sure enough: contact between the two stations is abruptly lost as Oscar III. dips below the radio horizon. The first QSO via Oscar III. satellite has been successfully completed! The record-making QSO, moreover, has been recorded on tape at both stations and has become a permanent record of the unique accomplishment.

This, then, is one way the first contact via Oscar III. may be expected to be made. No doubt, sooner or later, some Amateur will call CQ and receive an answer at random via the satellite. It is hoped, moreover, that transoceanic and transcontinental QSOs will be achieved by this unique repeater satellite. As this is the first time such an experiment has been undertaken, all prophesies and predictions are, of course, based upon intelligent guesswork and may prove to be invalid. The possibility exists that the satellite may be badly overloaded near areas of intense v.h.f. activity and remain silent but receptive over areas of the world where little v.h.f. activity is present.

REMOTE-AREA "BEACONS"

It is hoped that Amateurs in areas of the world having little v.h.f. activity will supply beacon signals that will activate the satellite to alert other, distant observers. A v.h.f. beacon transmitter in the Azores, for example, may activate Oscar III. over the North Atlantic area so that such passes may be heard on both sides of the Atlantic. A similar beacon near the Fiji Islands and one near India will activate the satellite over Pacific and Asian areas.

It is readily apparent that this new adventure of Amateur Radio is a voyage into the unknown, and no member of the Oscar crew really knows all the answers, or has a complete picture of the capability of Oscar III. Surprises for all will be in store when Oscar III. goes into orbit, and Radio Amateurs world-wide join Project Oscar in looking forward to a successful launch and an exciting and useful life for this 30-pound package of surprises.

ACKNOWLEDGMENT

Thanks to Don Nargaard, W6VMH for advice and assistance in the preparation of this article.

AMATEUR FREQUENCIES:

ONLY THE STRONG GO ON—SO SHOULD A LOT MORE AMATEURS!

[5] In this article, satellite frequencies are given in megacycles, and ground station frequencies are given in kolicycles.

[6] In this type of short-distance pass, with the satellite between the stations, the over-all Doppler shift through the translator will be very small.

SOME ASPECTS OF SPURIOUS RADIATIONS FROM AMATEUR TRANSMITTERS

R. S. GURR, VK5RG*

FROM time to time Amateurs experience criticism on their transmissions from other Hams, broadcast listeners, television viewers and sometimes from the P.M.G. The criticism is usually the result of some mal-adjustment of the transmitter, or may be due sometimes to the poor design in the original construction.

I think we all know the implications of complaints of t.v.i. and b.c.i., etc., and generally are able to see the problem through to some satisfactory conclusion. The main point of this article is to awaken Amateurs to the implications of complaints from other Amateurs.

We are short of frequencies for our experimenting, and general communication, and we are at present setting up a fund to fight for their retention —even in this magazine you read the repeated motto—"Use them or lose them". Are you one of those who would like to use them, but find that some other local (or not so local) Amateur is already using them—not just one of them, but sometimes all of them? If you switch off after that initial look at the band and go back to the lounge, rest assured you are not alone in your disinterest in the bands—stay with me and I'll try to tell you how to help "use them".

Are you perhaps one who offends? Got a harmonic? Of course it's not your fault, it's the other chap's overloaded receiver! Got key clicks? Gosh, what do you expect when he's only 200 yards away! S.s.b. splatter? Course it doesn't, I'm using a 3 kc. filter rig!

You, my friend, are the reason, in your own innocent way for some of the locals not being so active—no, you don't keep them off all the time, but you do make them switch off sooner than they would if you weren't there! Hence, while we have a number wanting to "use them", some don't for a reason that is actually controlled by other Amateurs, i.e. spurious emissions.

DEFINITIONS

Now at this stage the bush lawyers come into their own, but for want of better guidance, the Geneva 1959 Radio Regulations definition is quoted as "Spurious Emission—Emission on a frequency or frequencies which are outside the necessary band, and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emission, parasitic emissions and intermodulation products, but exclude emissions in the immediate vicinity of the necessary band, which are a result of the modulation process for the transmission of information."

The emphasis here is on "necessary band", as the only radiation that is not a spurious emission. Suppose an s.s.b. transmitter is designed for 3 kc. bandwidth, and at a mile away occupies 6 kc., then the transmitter is obviously radiating spurious signals. Suppose at a mile, the key clicks from a c.w. transmitter are 50 kc. wide, then again spurious signals are being radiated.

As a third example, the 20 metre phone DX-er half a mile away is S6 on 80, S7 on 40, S6 on 21 and S7 on 28 Mc. These are also spurious emissions.

Of course, the bush lawyers now reappear and criticise the receivers on which these observations are made. We don't all use Collins 51J4s, Eddystone 880s, Racal RA17s, etc., complete with panoramoscopes, but we should know our own receivers—that is we know its r.f. bandwidth, i.f. bandwidth, cross modulation characteristics, and best of all we know its "S" metre reading is accurate! (If you don't know these facts about your receiver perhaps they should be checked as there may be room for improvement.)

Anyway, suppose we assume all measurements are made on a good receiver, and we satisfy these bush lawyers, we are then for the moment capable in this field.

Now all these spurious emissions will show up as harmful interference to other Amateurs using the bands. Again we let the I.T.U. tell us what "Harmful Interference" is—"Any emission, radiation, or induction which endangers the function of a radio-navigation service or of other safety services or seriously degrades, destructs or repeatedly interrupts a radio-communication service operating in accordance with these regulations." This means to me that radiation of "spurious signals" is not desirable because they can cause "harmful interference" to other stations.

We now introduce another term into our discussion, "Occupied Bandwidth" and this is "the frequency bandwidth such that below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5% of the total mean power radiated by a given emission . . ." In simple terms, the occupied bandwidth is that between the 3 db. down points of our transmission.

Of course, this referring back and forth to academic definitions is not really the point of this article, but if you can bear with me a little longer, we may learn a couple of points of great interest!

(1) In Commercial allocations, usually a morse code (c.w.) signal is allocated a 100 c.p.s. band, a d.s.b. a.m. signal 6 kc., and s.s.b. 3 kc.

(2) After 1970, Commercial transmitters should be operated with spurious emission 40 db. below the fundamental and with maximum spurious power of 50 milliwatts.

(3) After 1970, it is hoped there will be no d.s.b. fixed services below 30 Mc., i.e. all h.f. fixed point/point services, etc., will be s.s.b.

EQUIPMENT DESIGN

We now compare the Commercial designer's problems with that of an Amateur, to show how different the two problems can be, but how one's techniques can influence the other.

The Commercial has to design a communications transmitter to tune any one of a number of frequencies over the range 2 to 30 Mc.—preferably with a minimum of tuning ranges and controls—quick frequency change—spurious output restricted to greater than 40 db. below fundamental. The Amateur has an easier job. He has only to achieve this suppression on a very small portion of the h.f. band and can consequently incorporate techniques that are more easily built into an Amateur rig. The Ham who stops at 40 db. and goes no further is not to be condemned, but to achieve greater than this is relatively easier for the Ham than the Commercial.

The P.M.G. Handbook suggests we are allowed to radiate harmonics providing they fall in an Amateur band, but here again we are back to the original thought of interfering with other locals.

Hence, to keep our signals clean shows that we can do the following:—

(1) Keep the locals happy and help them use the band more often.

(2) Show the Commercials that we can equal or better their specifications.

(3) Let the P.M.G. know their rules are way behind the standards used by Amateurs.

SOME CURRENT PRACTICES AND CURES

I venture now to discuss at random some of the shortcomings of Amateur transmitter design with respect to this spurious radiation problem. The tendency is due somewhat to the limited attention given in the various publications. In recent years shielding, bypassing and filtering techniques adequate for the suppression of v.h.f. harmonics have been developed and used extensively with great success to prevent t.v.i.

These designs, however, have not included much thought for the cure to radiation of lower frequency spurious signals. The >30 Mc. cut-off filters still let through the 3.5 Mc. harmonics to 30 Mc. and in some cases these spuriouses are mighty powerful. Some construction articles even include an antenna coupling unit as an afterthought! The use of fairly high power for frequency multipliers is still popular (6AG7, 5763, 6L6, etc.), and capacity coupling between these stages is

* 9 Richmond Avenue, Col. Light Gardens, S.A.

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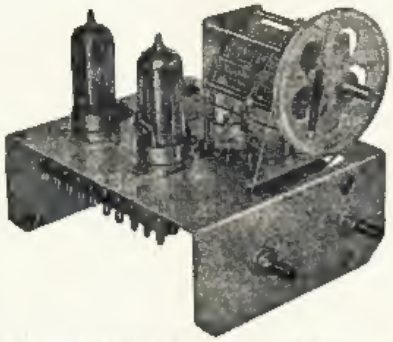

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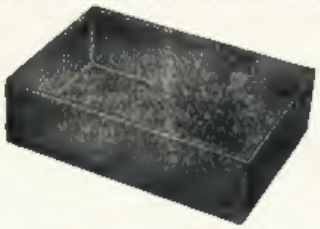

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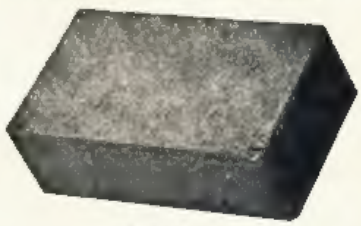

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I make open condemnation of the rig that uses a Geloso v.f.o. to drive an 807 or 6146 with a pi-network tank, coupled to a multi-band dipole. Brother, you have more total power coming out at spurious frequencies than you do at your fundamental! This type of line-up can be improved by using an aerial coupling unit between the p.a. and the multi-band aerial, and an even greater improvement obtained by installing a tuned buffer amplifier between the Geloso and the p.a. Driving any power amplifier with a frequency multiplier is not good practice, but if it cannot be avoided due to power supply economy, etc., the drive to the p.a. should be as pure as possible—the use of bandpass inductive coupling is satisfactory in most cases, and prevents too much of the multiplier's drive frequency from getting through to the p.a. grid.

As you know, the pi-network has some chance of preventing the transmission of harmonics of the amplifier drive frequency, but it has **no** chance of stopping frequencies below this design frequency if they reach the grid of the p.a.—once generated, these lower frequencies (sub-harmonics?) can best be stopped by an antenna coupler, but suppression to a very low level cannot be expected if this is the only circuit working to prevent their radiation.

I have no condemnation for the multi-band aerial, be it tri-band beam, multiple dipoles, long wires, zepps, etc., as these will not contribute greatly to the level of spurious signals if the spurious are not allowed to leak past the aerial coupler. The use of half wave filters to obtain further attenuation in difficult cases is also popular, while the inclusion in all transmitters of low pass filters with cut off at 30 Mc. is good insurance against spurious signals at v.h.f. with resultant freedom of interference to taxi services, t.v. channels, radio-telephone links, etc.

The generation of single sideband at a low level and the use of efficient linear amplifiers results in strong signals and fewer harmonics—here again, good exciter design in which only the frequency it is desired to amplify is applied to the p.a. grid, is essential. The use of an aerial coupler is again necessary to enhance the reduction of spurious signals.

SPURIOUS EMISSIONS NEAR THE TRANSMITTER FREQUENCY

Audio peak clipping, overmodulation indicators, low pass filters, etc., are all extremely useful to ensure the band transmitted is not excessive. There are plenty of good articles dealing with this aspect alone, written by reliable authors, elsewhere.

Key click filters, electronic keying systems and such are helpful in preventing keying transients. Why should the mere switching on and off of 150 watts of r.f. cause a click 10 kc. away from one transmitter and not from another? Every c.w. transmitter should have in its initial design the best key click suppression possible. Think of the others on the band—not only of the b.c.l's

With s.s.b. most of the bandwidth restriction is done for us long before we hit the p.a. or linear. Here, however, a lot of s.s.b. rigs go wrong, and in this field just at the moment, more and more stations are offending. With filter rigs the narrow bandpass is built in usually, but I suppose one day someone will bob up quite legally with a 10 kc. passband filter rig and make everyone scratch their heads!

With the phasing rig, audio band suppression is essential before the phase shift network—that is, don't hit a 2Q4 or Aswel phase shift net designed for 300 c.p.s. to 3,000 c.p.s., with hi-fi—the result will be horrible and add up to more kilocycles of bandwidth than you ever used on a.m.!

SUPPRESSION TOLERANCES AND CHECKS

To measure the amount of attenuation with normal Ham transmitter design takes a lot of time and accurate equipment. Measurements in terms of decibels below the fundamental are easily obtained, but don't do it on your Ham receiver "S" meter or you will finish up with stronger spurious signals than fundamental. If you operate 20 metres and the local 200 yards away can hear you on 80 or 40 at S3 or better, you have more work to do. If he can hear you on 15, also return to your soldering iron, but if he complains of an S3 on 10, then he will have to put up with it, because this is good suppression.

If the local living at a mile hears you on any band but 20 metres, then you have not achieved all it is possible to achieve.

With respect to splatter and key clicks, if you throw all your selectivity in (and 500 c.p.s. bandpass is not impossible), tuning through a c.w. signal should produce clicks only when the signal is in the centre of the receiver bandpass—adjust the r.f. input (by aerial attenuator if possible) to the receiver until the "S" meter reads some high but normal value. (An "S" meter calibrated in db. above 1 μV. aerial input is the best in my opinion.) Now if the receiver is detuned 3 kc., and the key clicks are kicking up to a value 60 db. below the original, then obviously, although they still exist, the spurious signals are well attenuated

This assumption can only be made when a receiver of "knife edged" selectivity is used, and for the purpose of the above observation, the "window" or "knife edge" are looking through at the frequency band of the transmission, is very much smaller than the actual transmission width. Taking this type of check even further, if we had a receiver of 100 c.p.s. bandpass and tuned 1 kc. away from the edge of "clean" 3 kc. speech transmission, we would see little "splatter" at all.

Checking your key clicks and splatter by this means can also be done by using the image of your own transmission in your receiver. If transmitting on 14 Mc., my own Eddystone 680X is of course blocked completely on this frequency, but when I tune it to 13.9 Mc., where the image is many db. down, I can view my own signal as that of a remote one. With crystal filter in and bandpass down to minimum, speech modulation and key clicks can be adjusted until listening 5 kc. outside the transmitter "occupied band", they are reduced to nothing. Try it sometime.

TESTIMONIALS

I unfortunately don't completely practice everything I preach in this field for a number of reasons However, I list below some cases I have been involved in, wherein I have proved to myself and others, that it is posible to live with your Ham neighbour—even more so if he recognises his transmitter and receiver deficiences and corrects them:—

(1) Macquarie Island 1952 (VK1RG): AT20A transmitter, 400 watts of high level modulation on 14415 kc. At a distance of 200 yards, I could operate a 50 watt output a.m. rig on 14350 kc. with **no** mutual interference, i.e. I did not know the Commercial rig was on and neither were the Commercial operators aware of my 14350 kc. Amateur transmission. With an extension speaker on the Commercial receiver, I was able to observe the influence as the Ham rig was moved closer in frequency and came as close as 30 kc. away before any sign was noticed on the Commercial circuit. (14350-14400 kc. was still Amateur territory in those days.) On the Ham receiver, the 400 watt rig influenced reception 50 kc. or so from its frequency.

(2) VK5ZB/VK5RG, 1954-57: Steve and myself are 400 yards apart and we used at this stage 100 watts each and two element ZL Specials on 20 metres, each 30 ft. high. Beaming at one another, we flattened each others receivers over 80 kc. of the band, but with each beaming on the States, when beams end on to each other, we could work 20 kc. apart and unaware of the others activities.

(3) VK5ZL/VK5RG, 1954-57: Albert has more power than Steve, but is about 100 yards closer to me. We have existed together on the same band only 50 yards apart, on phone, and no need to close down! I beam right at him when I fire at the States and he at me when he fires to South Africa.

(4) VK5ZL/VK5ZB/VK5RG: The three of us have used 20 metre phone continuously in Remembrance Day Contests over the years and have simultaneously had contacts between 14100 kc. and 14200 kc. with Interstate stations and no mutual interference. There is no sign of either 5ZL or 5ZB at 5RG when I listen on 40 metres while they are on 20 metres.

(5) VK9RO/VK9XK: Russ and myself were about 400 yards apart in Port Moresby, both keen on phone and c.w. and also contests, yet no need ever to close down because the other was on the bands. I have worked stations on frequencies as close as 5 kc. from Russ on c.w. and we were each unaware of the other until later, when discussing our respective QSOs.

(6) VK9RO/VK9AT: Tests on 40 metres on a Geloso driving a pi-network to a 40 metre dipole coax. fed. VK9RO heard by Eddie at half mile on 20 metres at S8 signal. With aerial coupler, using Faraday shielded link on antenna coil, no sign of VK9RO on 20 metres.

(Continued on Page 16)

For More Sock in Your Signal, Build the . . .

ANTENNA ANALYSER*

HERB. FRIEDMAN, W2ZLF

WE know a fellow who abandoned his Ham gear for a while to spend his time sticking pins into the effigy of his next-door neighbour. Why? Because the neighbour's flea-power rig outperformed his super-duper, high-priced outfit every time.

If he had spent less time with the pins our friend might have realised all he had to do was get his antenna system tuned to razor's edge Think it's a task to be dreaded? Well, listen. "E.I's" Antenna Analyser can determine antenna and feedline resonance, system impedance, s.w.r. and radiation resistance (antenna impedance) quicker than you can say voodoo!

The Analyser requires an input signal which can come from your v.f.o. or g.d.o. A one or two-turn coil placed near one of your transmitter's low-power stages, or from your g.d.o. coil, will pick up a sufficient signal for the Analyser.

The Analyser's range extends up to 30 Mc. and it will work with twin-lead or open-wire line. If you use coaxial cable, replace SO2 with a coax connector.

CONSTRUCTION

Except for M1 and SO2, use the components specified. If you use short direct leads and are careful about parts placement, the range can be extended up to 54 Mc. But on 2 metres, both M1 and R2 must be individually shielded with aluminium foil. Mount M1 as close as possible to the top of the U-section of a 5¼" x 3" x 2⅛" Minibox. This will leave the greatest panel area for the knob and calibrations.

M1 should be at least a 200 microampere meter. If you can afford a 100 microampere meter, so much the better. Such meters are still available on the surplus market at low prices. Don't use an inexpensive imported in this application—they are too stiff for critical adjustments.

R2 must be insulated from the cabinet with a half-inch length of 3/8-inch i.d. plastic tubing. Cut the tubing so the ends are squared off. Coat R2's mounting bushing with Q-dope, taking care that it does not get into the control. Push the insulator on to R2's bushing (screw the mounting nut all the way on R2 first) and set it aside for a few hours. When the Q-dope is half-hard, carefully unscrew the plastic tubing and let the Q-dope in it dry overnight. When the Q-dope dries, one end of the tubing will have threading moulded in it. Re-coat R2's bushing with Q-dope and force the **unthreaded** end of the plastic insulator on R2. When the Q-dope dries, the insulator will be permanently attached to R2. Then push the plastic shift into R2 and fasten the assembly to the panel with a standard 3/8-inch panel bushing.

Position input connector SO1 and antenna socket SO2 so their lugs line up with R2's terminals. Make certain D1's polarity is correct and take care that it is not overheated when soldering. Complete all wiring except the connection from R2 to SO1 which will be made after calibration.

CALIBRATION

If you plan to use a g.d.o as a signal source, use the resistor specified for R4. However, if you use your v.f.o. or a link pick-up from the transmitter, M1 may be driven off scale. To prevent this, change R4 to 47,000 ohms. If you think you may use either a v.f.o. or a g.d.o., R4 should be a compromise of about 24,000 ohms.

Set R2 full counterclockwise and connect an ohmmeter across it. Rotate R2 until the ohmmeter indicates 25 ohms, then put the 25-ohm mark on the front panel. Do the same for 50, 75, 100, 150, 200 ohms, etc., up to 500 ohms. Since R2 is linear, in-between points can be easily added. If you are only interested in a limited range of impedances (such as 25 to 100 ohms), use a 100-ohm pot. for R2. Full clockwise rotation will now correspond to 100 rather than 500 ohms.

After calibration connect R2 to SO1 and check the calibration by inserting **carbon** resistors in SO2. Connect the signal source to SO1. A v.f.o. can be fed directly to SO1. If you use a g.d.o., connect a one or two-turn coil to the Analyser and slip it over the g.d.o's. coil. Move the loop over the g.d.o's. coil until you get a maximum deflection on M1. Rotate R2 until M1 indicates a null. If the resistor connected to SO2 is 50 ohms, R2 should be opposite the 50-ohm mark. If the unit is correctly wired, the null will be at absolute zero or very close to it. If you get only a partial null, the wiring in the Analyser may be sloppy. If the calibration is consistently off, readjust the knob on R2's shaft or re-mark the dial. If calibration is off badly, look for a wiring error.

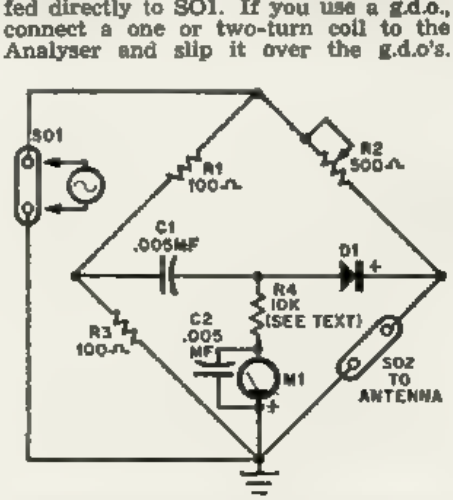

Fig. 1.—Simple bridge circuit is balanced when antenna system impedance is same as resistance of R2. Input voltage does not have to be held constant.

R1, R3—100 ohms, ½ watt, 1% resistors.
R2—500 ohms, linear-taper carbon potentiometer (I.R.C.—CTS45 Taper A).
R4—10,000 ohms, ½ watt, 10% resistor (see text).
C1, C2—0.005 μF 500v. disc capacitors.
D1—1N34A diode.
SO1, SO2—Crystal socket or chassis-type coaxial connector
M1—0-100 microammeter (see text).

OPERATION

You'll get greatest accuracy from the Analyser when it is connected to the antenna through a half wavelength (or multiple of a half wavelength) feedline. The half wavelength line acts as an impedance matching transformer. If you connect a 50-ohm impedance to one end of the feedline, the other end will appear as 50 ohms. (To keep the power-transfer loss low, feedlines should always be a half wavelength, or multiple thereof, long.)

Here's how you use the Analyser to determine the exact length of the half wavelength feedline. Cut the line a little longer than the calculated length. Connect the line to SO2 and feed a signal at your operating frequency to SO1. Set R2 to zero ohms and short the open end of the line. M1 will indicate up-scale. Cut off small sections of line then short the line. When the line is exactly a half wavelength long, M1 will null. (The length of a quarter-wavelength section of line is determined the same way except the free end is **not** shorted.)

Now for antenna measurements. Connect your antenna to the free end of the half wavelength feedline and rotate R2 for null. This setting is the antenna's radiation resistance (impedance). A complete null means the antenna is resistive and is precisely tuned to your operating frequency. If the null is not perfect, the antenna is reactive and not resonant at the operating frequency

S.w.r. can be determined by dividing the antenna impedance by line impedance. If the antenna impedance is 100 ohms and you are using a 50-ohm line, the s.w.r. is 100 ÷ 50, or 2. If the answer comes out less than 1, invert the formula so the larger number is on top.

To use the Analyser to peak-tune an antenna or matching network, connect the antenna (with a feedline) to SO2 and set R2 to the desired impedance. Feed a signal at your operating frequency to SO1. When you have adjusted the length of the antenna or its tuning device (gamma-match) and obtained a null, the system will be properly tuned.

(Continued on Page 11)

TRANSEQUATORIAL PROPAGATION RESEARCH

C. G. McCUE*

THERE have been many reports since 1947 of unusual v.h.f. propagation over very long distances, sometimes exceeding 9,000 km., in directions more or less transverse to the equator. The frequencies involved have been as high as 90 Mc. during sunspot maximum and are usually in excess of any frequency which would be expected to propagate over these distances.

As an Australian contribution to the International Quiet Solar Year (I.Q.S.Y.) 1964-65, the Weapons Research Establishment, Department of Supply, has commenced a study of transequatorial propagation (T.E.P.) in collaboration with the Radio Research Laboratories (R.R.L.) of the Japanese Ministry of Posts and Telecommunications, the United States Army Signals Corps on Okinawa, and the Townsville University College (T.U.C.) in North Queensland.

* Box 1424H, G.P.O., Adelaide, South Aus.

No.	Call Sign	Schedules	Mc.
1	JA1YEN	A,B,C, D,E	49.00
2	JA1FG	F	
3	JA1ACZ	A,E	49.00
4	JA1DRB	F	49.00
5	JA1FUI	F	72.71
6	JA1JHA	A,C,F	32.85, 72.71
7	JA1MIB	E,F	49.00
8	JA2AC	F	49.00
9	JA2AUC	A,B,C, D,E	32.85
10	JA2BZY	A,B,C,D, E,F,G	49.00
11	JA2OLK	F	49.00
12	JA2CCY	C	49.00
13	JA3AER	F	49.00
14	JA3CEJ	F	32.85
15	JA4SF	A,E,F	49.00
16	JA4BPH	D	49.00
17	JA5ABY	F	49.00
18	JA7KC	F	49.00
19	JA7JE	F	49.00
20	JA7MA	F	49.00
21	JA7OR	A,C	49.00
22	JA7TI	E	49.00
23	JA7ZL	F	49.00
24	JA7AJI	F	49.00
25	JA7CCN	G	49.00
26	JA8FY	C	49.00
27	JA8PD	A,C,D,E	49.00
28	JA0DA	E	49.00
29	JA0KF	C,D,E	49.00
30	JA0AGA	F	49.00, 72.71
31	JA0AMH	F	32.85
32	JA0AXV	F	49.00
33	JA0ATY	F	49.00
34	JA0BDG	E,F	49.00

Table 1.

In part of this work, three 1kw. transmitters using Yagi aerials transmit on 32.85, 49.00 and 72.71 Mc. from Darwin and are received by R.R.L. engineers at Yamagawa in southern Kyushu in Japan. The transmissions are c.w. with the call sign VL5SA, repeated every ten minutes.

The author visited Japan during May and June in connection with this experiment. While there, he met Messrs. T. Kuwahara (JA1CR) and Y. Noguchi (JA1MKS) on behalf of the Japanese Amateur Radio League. They informed the author that many Japanese Amateurs have agreed to observe the Darwin transmission on a regular basis and to report their observations to Mr. S. Hara (JA1AN), who is organising this work. Mr. Hara will forward the reports to the scientists at R.R.L. The voluntary efforts of the Japanese Amateurs in observing the Darwin transmissions will add considerably to the knowledge to be gained from the Japan-Australia experiment. The Amateurs will present the scientists with data covering a geographical spread not otherwise obtainable.

Schedule Letter	Schedule
A	Observe on world days from 2000 to 2400 hours J.S.T.
B	Observe on world days from 2400 to 0300 hours J.S.T.
C	Observe on Sundays from 1000 to 1200 hours J.S.T.
D	Observe on Sundays from 1200 to 1600 hours J.S.T.
E	Observe on Saturdays from 2000 to 2400 hours J.S.T.
F	Observe irregularly but keep a log of times.
G	Use a pen recorder during observing periods.

Table 2.

Table 1 lists the call signs of Japanese Amateurs known by the author to be co-operating with Mr. Hara, the frequency which each will monitor, and the schedules which they will follow. The schedules are explained in Table 2. It should be mentioned that "World Days" are days when scientists and engineers in the fields of ionospheric physics, radio, geomagnetism, meteorology, aurora, cosmic rays, airglow, aeronomy, and solar activity make specially concentrated efforts to obtain data. World Days occur on three consecutive days each month, always a Tuesday, Wednesday, Thursday near the middle of the month. The World Days for September 1964 to December 1965 are listed in Table 3.

During the I.Q.S.Y., the Japanese Amateur Radio League is continuously operating three 50w. transmitters from Tokyo on 29.0 (A2 emission), 50.5 (A1), and 145.35 (F2) Mc. The aerials are simply horizontally polarised Yagis which rotate once a minute. The station call sign is JA1IGY.

It would be of great value to the author's research if some Australian Amateurs would monitor the two lower Japanese frequencies according to one or more of the schedules listed in Table 2. Any Amateur willing to do this should contact the author by writing to him at Box 1424H, G.P.O. Adelaide, South Australia.

The type of information required by the author would be the times when the operator attempted to hear the Japanese signal, the times when the operator could hear the signal, and an R-S-T report. It must be emphasised that reports of signal not heard when contact is attempted are as useful as reports of actual contacts.

Month and Year	Dates of Regular World Days
September, 1964	22, 23, 24
October, 1964	20, 21, 22
November, 1964	17, 18, 19
December, 1964	15, 16, 17
January, 1965	12, 13, 14
February, 1965	16, 17, 18
March, 1965	16, 17, 18
April, 1965	20, 21, 22
May, 1965	18, 19, 20
June, 1965	15, 16, 17
July, 1965	20, 21, 22
August, 1965	17, 18, 19
September, 1965	14, 15, 16
October, 1965	19, 20, 21
November, 1965	16, 17, 18
December, 1965	14, 15, 16

Table 3.

☆

ANTENNA ANALYSER

(Continued from Page 10)

Sometimes (as with mobile whips) you do not know what the antenna's resonant impedance should be. To determine it, connect the antenna to the Analyser with a half wavelength section, and set the generator to your operating frequency. Adjust the antenna as you turn R2 back and forth (at this time you are not interested in exact impedance) until you obtain a null at some setting of R2. The antenna is precisely tuned at the null. R2 indicates the antenna's radiation resistance. Knowing this, you can use the tables in the A.R.R.L. Antenna Book to determine the length of transmission line needed for a **matched** antenna system. Remember, it's only when the antenna system is matched and tuned for resonance that all transmitter power is coupled to the antenna. Don't forget that the Analyser must always be connected directly (or through a half wavelength line) to the device under test. ●

SERIES AND PARALLEL MODE CRYSTAL OPERATION FOR V.H.F.*

JOHN J. NAGLE, W3JES

AN interesting and informative article has recently appeared concerning the performance of overtone crystal controlled oscillators when operated in a high impedance or anti-resonant mode.[1] The use of overtone crystals in a low impedance or series-resonant mode offers several advantages over parallel mode operation. It is the purpose of this article to describe these advantages. This will be done by explaining the principal differences between series and parallel mode operation and examples of both types of circuits will be given. It is the author's belief that the biggest stumbling block to the use of series mode crystal controlled oscillators has been the difficulty in adjusting the oscillator for true series operation of the crystal. A method for doing this is also given.

The author of the above mentioned article describes the use of overtone crystals when operated in a high impedance or anti-resonant mode. The circuit described has the advantage of simplicity and economy of parts. However, it also has the disadvantage that the frequency is dependent on the capacity that is in parallel with the crystal. The major portion of this capacity is the input capacity of the oscillator tube; this capacity, in turn, is composed of grid-to-cathode capacity which is usually constant plus the grid-to-plate capacity multiplied by the voltage amplification of the tube (Miller capacity). Since the voltage amplification depends on the value of load impedance it can be seen that the frequency of oscillation depends on the load impedance.

• This article describes the difference between series and parallel mode operation of crystal oscillators. Examples of both types of circuits are explained and a method is described for adjusting an oscillator for true series operation, frequently a difficult task, and a practical circuit is presented for 2 metre operation.

SERIES MODE

Before proceeding further it is desirable to consider the difference between series and parallel operation of a quartz crystal unit. A quartz crystal unit may be represented by the circuits shown in Fig. 1.

The components L_x, C_x and R_x represent the piezo-electric effect of the quartz crystal. The capacitor C_s is a physical capacitance caused by the capacity of the electrodes on the crystal, the stray capacity of the crystal holder and socket, and the input capacity of the oscillator tube or other device connected across the crystal. At a frequency known as the "series resonant frequency" of the crystal, L_x and C_x are resonant. From the definition of series resonance the impedance of the $L_xC_xR_x$ arm becomes R_x so that the impedance looking into the terminals of the crystal is R_x and C_s in parallel. Typically, the value of L_x is several henries (not millihenries or microhenries, but **henries!**); R_x is less than 50 ohms for overtone crystals operating in the 30-60 Mc. range. (The author has measured the resistance of one 40 Mc third overtone crystal to be 8 ohms!) Since L_x and C_x are resonant at the operating frequency, the value of C_x must be a small fraction of a micromicrofarad. As the inductance of L_x is several henries, the reactance at all Amateur frequencies will be in the order of several megohms. The ratio of a reactance of this magnitude and the relatively low resistance of 50 ohms or less gives a very high value of Q. ($Q = X_L/R_x$.) It is this exceptionally large Q that makes the quartz crystal so useful in frequency control and filter applications.

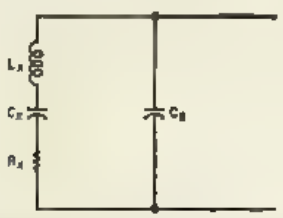

Fig. 1.—The equivalent circuit of a quartz crystal. The capacity Cs represents the holder capacity plus the input capacity of the oscillator circuit.

It should be noted that the frequency of series resonance depends only upon L_x and C_x which are intrinsic properties of the quartz crystal itself; this frequency does not depend upon the value of C_s and hence the frequency is independent of the circuitry in which the crystal is used.

PARALLEL MODE

If the frequency is increased from the series resonant frequency the reactance of the series arm becomes inductive; this is because the reactance of the inductance, L_x, increases with frequency while the capacitive reactance of C_x decreases with frequency so that the difference between the two is no longer zero but shows a net inductive value. At some frequency above the series resonant frequency, the inductive reactance of the series arm will become anti-resonant (or parallel resonant) with the shunt capacity C_s. This frequency is known as the "parallel resonant frequency" and the crystal circuit appears as a high impedance at this frequency.

A crystal controlled oscillator may be designed to operate at either the impedance rise at parallel resonance or the impedance dip at series resonance. The same design will obviously not operate at both series and parallel resonant frequencies.

Two points should be borne in mind. First, the parallel resonant frequency is always higher than the series resonant frequency. Second, the parallel resonant frequency depends on the stray capacity that the circuit places across the crystal while the series resonant frequency depends only on parameters of the crystal unit itself. If it is desired to operate a crystal at its parallel resonant frequency it is necessary to specify the value of load capacity that the crystal will see. Within the last few years this value of capacity has been standardised at 32 pF for most applications. A crystal ground for parallel operation will oscillate at its name-plate frequency (within its tolerance) when the circuit presents a load capacity of 32 pF. across the crystal terminals.

Amateurs using surplus crystals, especially World War II. surplus, should use caution where accuracy of frequency is important. At the time World War II. crystals were manufactured, a standardised value of load capacity had not come into general use and where high accuracy was required it was customary for the crystal user to supply the crystal manufacturer with a sample circuit to which the manufacturer tailored the crystal. Since most Amateurs do not have access to equipment for accurately measuring frequency, especially in the frequency region where overtone crystals are most likely to be used, and since the input capacity of an oscillator tube is not easily determined, operation of the crystal in a manner such that the capacity across the crystal has only a small, if any, effect on the frequency of oscillation has certain advantages.

Typical examples of oscillators which use crystals in the parallel mode are shown in Figs. 2 and 3. Fig. 2 is perhaps the most commonly used circuit. It is a modified form of the tuned-grid tuned-plate oscillator in which a parallel resonant crystal is substituted for

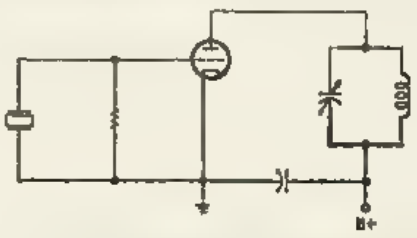

Fig. 2.—The Miller crystal oscillator circuit is a modified form of the tuned plate tuned grid circuit.

* Reprinted from "CQ," April 1964.

[1] Ellis, R., "Frequency Stability of Third-Overtone Crystal Oscillators," "QST," January 1963, p. 68.

the grid tank circuit and is known as the Miller oscillator. Fig. 3 is the well known Pierce oscillator and has the advantage that no tuned circuits are involved. Most of the other parallel mode circuits are modifications of either of the above.

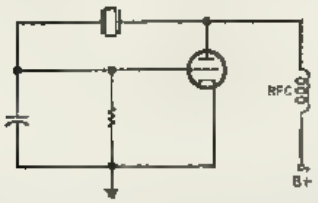

Fig. 3.—Basic circuit of the Pierce crystal oscillator. Note the lack of tuned circuits.

A good example of an oscillator using a crystal in its series mode is the Butler oscillator, shown in Fig. 4. Here the crystal serves as a series coupling element. At the series resonant frequency the crystal impedance is the lowest; the feedback is a maximum and the circuit oscillates at this frequency. At all other frequencies the crystal impedance is higher; since the crystal is a series element in the feedback path, the feedback will be reduced. If the circuit is properly designed, oscillations will take place only at the series resonant frequency.

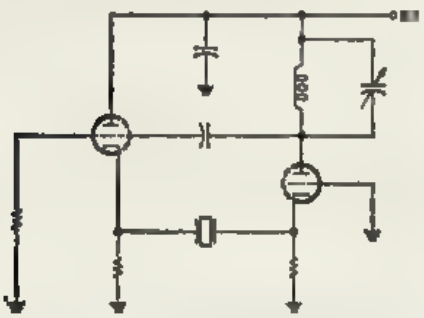

Fig. 4.—The basic Butler oscillator circuit uses the crystal as a series coupling element.

Perhaps a more familiar oscillator circuit using series resonance is the Clapp oscillator[2,3] shown in Fig. 5. Although this circuit is usually seen as a variable frequency oscillator it was originally developed as a crystal controlled oscillator for a broadcast frequency monitor. The characteristics of this circuit that make it so popular as a variable frequency oscillator apply equally well to the crystal controlled case.

There are many other circuit configurations using series mode crystals, too numerous to describe here. However, a modification of the Miller circuit to use series mode crystals will now be described.

As mentioned above, the series resonant frequency of a crystal will depend only on the crystal unit itself; the stray capacity across the crystal will have only a very minor effect on the frequency of oscillation. The Miller circuit can be easily adapted to use a crystal in its low impedance (or series) mode by use of an artificial quarter-wave line.

[2] "A High-Stability Oscillator Circuit," "QST," May 1948, p. 42.

[3] Clapp, J., "An Inductance Capacitance Oscillator of Unusual Frequency Stability," "Proceedings of The I.R.E.," March 1948, p. 356.

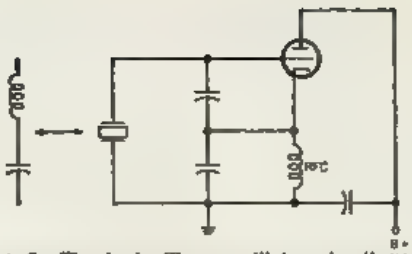

Fig. 5.—The basic Clapp oscillator circuit uses the crystal in the series mode. The L-C equivalent is also shown.

TRANSMISSION LINES

It can be remembered from transmission line theory that a quarter-wave section of transmission line has an impedance inverting property. In Fig 6, if the load impedance Z_L is less than the characteristic impedance, Z_0, of the quarter-wave section, then the impedance seen at the input terminals of the line, Z_{in}, is greater than the characteristic impedance of the line. Mathematically:

$$Z_{in} = \frac{Z_0^2}{Z_L} \qquad (1)$$

The reverse is also true. The equivalent of a quarter-wave matching section can be made from lumped constants in the form of a pi-section network shown in Fig. 7 where X_L equals X_0 at the frequency of operation. The characteristic impedance of such a section is given by $Z_0 = X_L = X_0$.

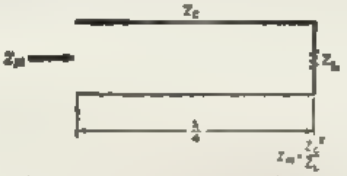

Fig. 6.—The impedance inverting characteristics of a quarter-wave transmission line.

For our purpose we will place a crystal, operating in the series mode, at one end of the network; this will be transformed into a high impedance looking into the other end of the network. The high impedance end will be connected to the grid of the oscillator tube as shown in Fig. 8. In order to obtain as high an impedance as possible at the grid end of the network, Equation (1) shows that (a) the crystal series resistance should be as low as possible, and (b) the characteristic impedance of the quarter wave section should be as high as possible.

Condition (a) above imples that the crystal unit should have as high a Q as possible. Condition (b) states that the shunt capacity should be as small as possible and the series inductance should be as large as possible, bearing in mind that the inductance and capacity must be resonant at the operating frequency. The minimum possible shunt capacity is equal to the input capacity

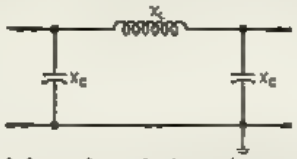

Fig. 7.—A lumped constant quarter-wave transmission line. At the operating frequency ZC equals XL equals XC.

of the tube, so that by making the input capacity of the tube the shunt capacity of the network, one physical capacitor is eliminated. In practical cases the series resistance of the crystal unit will be small compared to the reactance of the physical capacitor shunting the crystal so that this capacitor can also be eliminated. It is also necessary to add a grid resistor. The resistor can be put at either end of the impedance transforming network; since the crystal end has the lowest r.f. impedance, the grid resistor will be placed in shunt with the crystal. This will not degrade the performance of the crystal unit since a typical value of grid resistor is 100K ohms, while the series impedance of the crystal unit is typically less than 50 ohms. The circuit is now as shown in Fig. 9.

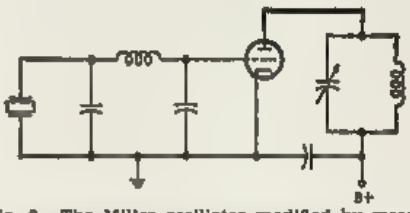

Fig. 8.—The Miller oscillator modified by means of an impedance inverting quarter-wave transmission line enables series mode operation of the crystal.

COIL DATA

The only problem that remains is to specify the coil. The coil must resonate at the operating frequency with the input capacity of the tube. As mentioned above, the input is difficult to determine exactly so that the coil must be made adjustable.

The impedance inverting coil used is ¼" long by ¼" diameter close wound with No. 20 enamel wire (8 turns); the slug is green-dot iron. If the best adjustment seems to be obtained with the slug in the maximum inductance position, the inductance is probably too small and the coil should be rewound

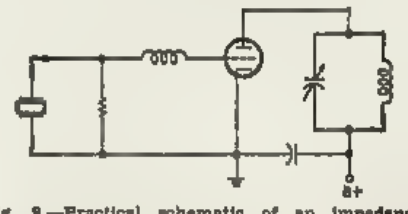

Fig. 9.—Practical schematic of an impedance inverting Miller oscillator.

keeping the same dimensions but using the next size smaller wire. If the best adjustment seems to be with the slug removed the coil is probably too large and it should be rewound using the next size larger wire again keeping the same dimensions. Keeping the same physical dimensions and changing only the wire size insures that the inductance is changed by controlled amounts. I have found that this is a better procedure than keeping the same wire size and changing the coil dimensions.

If the coil is to be made adjustable, some indication must be provided to tell when the proper adjustment has been made. It is believed that this "proper adjustment" problem has been

the principal reason that the performance of series mode overtone oscillators has not been as good as it should be.

ADJUSTMENT METHOD

When the oscillator is operating on the proper frequency, the crystal will be in series resonance and the r.f. voltage across it will be a minimum. Hence by placing an r.f. voltmeter across the crystal and adjusting the grid coil for minimum voltage, operation of the crystal at its series resonant frequency can be determined. For convenience, the voltmeter circuitry can be made a permanent part of the oscillator and a d.c. test meter connected to test points for tune up. A complete oscillator and voltmeter circuit is given in Fig. 10. The voltmeter has an input impedance of approximately 50K ohms; since the series resistance of the crystal unit is less than 50 ohms, the effect of the voltmeter is negligible. In fact, when testing, connecting the 500 pF. capacitor to the crystal no change in the oscillator beat note could be detected by ear.

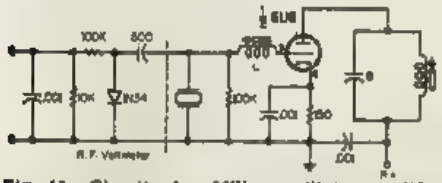

Fig. 10.—Circuit of a Miller oscillator modified with an impedance inverting quarter-wave transmission line and an r.f. voltmeter to aid in the adjustment of inductor L.

The voltmeter also provides a convenient method of measuring crystal dissipation. The d.c. voltage developed across the 100K voltmeter resistor is very nearly equal to the peak value of the r.f. voltage across the crystal unit. The d.c. voltage is given by 100,000 $I_{d.c.}$, where $I_{d.c.}$ is the meter reading in amperes. Hence

$$E_{d.c.} = 100{,}000\ I_{d.c.} \approx E_x\ (r.f.)$$

The power dissipated by the crystal, P_x, is given by:

$$P_x = \frac{E_x^2\ (r.f.)}{2R_x}$$

where R_x is the crystal series resistance. The dissipation for most types of overtone crystals in the 25-75 Mc. frequency range should be less than 2 milliwatts.

As a final test, before putting any overtone oscillator into actual operation, a receiver should be tuned to approximately one-third the name-plate frequency (assuming a third overtone crystal) for evidence of oscillation at the fundamental. Any signal output indicates that the crystal is oscillating at its fundamental frequency instead of the overtone frequency and that the oscillator tube is acting as a frequency multiplier. The output will therefore be high in harmonic content (harmonics of the fundamental) which would not be present if the crystal were operating on its proper mode. These harmonics are not only undesirable in themselves, but they represent energy that could better be used at the desired frequency. In addition, inadvertent operation of an overtone crystal at its fundamental frequency almost always results in excessive crystal dissipation which can cause a high drift rate or even damage the crystal.

The absence of any output at the fundamental frequency or multiples thereof (except of course the desired overtone and multiples of the desired overtone) insures that the crystal is operating in the proper fashion.

Use of the minimum voltage adjustment procedure previously described will give optimum performance of the oscillator.

Although overtone crystals are not capable of dissipating as much power as crystals operating in the fundamental mode, it is possible nevertheless, to obtain, from properly adjusted and controlled overtone oscillators, a reasonable amount of power with a minimum amperes; the crystal resistance was measured to be 15 ohms so that the crystal dissipation is less than 2 milliwatts. Thus in two envelopes it has been possible to use an overtone crystal oscillator, with the crystal operating well below its maximum ratings, to go to the two metre band with sufficient power output to drive a high power amplifier This arrangement has an advantage as far as t.v.i. is concerned; no harmonics of the oscillator fall in a television channel and t.v.i. problems are simplified

The same basic oscillator circuit can also be used in the 6 metre band with excellent results.

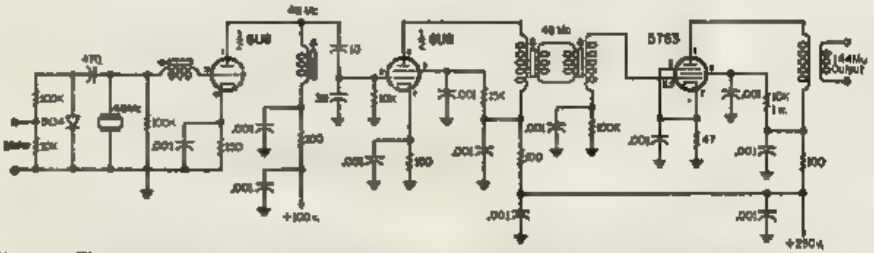

Fig. 11.—The oscillator-multiplier chain above uses a series mode overtone crystal. Only two tubes are required to provide an approximate one watt output in the two metre band.

number of envelopes. As an example, the oscillator-buffer-tripler combination used by the author to go from 48 Mc. to 144 Mc. is shown in Fig. 11. In this arrangement the triode section of a 6U8 is used as the oscillator operating on 48-49.3 Mc. The pentode section of the 6U8 is used as a buffer amplifier. The drive for the buffer is tapped down from the oscillator tank circuit to avoid overdriving the pentode section and to provide better isolation between the pentode and the oscillator. The output of the buffer amplifier is more than sufficient to drive a 5763 as a tripler to its full output of approximately one watt at 144-148 Mc. The d.c. current through the 100K resistor in the r.f. voltmeter circuit is less than 2 micro-

SUMMARY

In conclusion the difference between the series and parallel modes of a quartz crystal unit has been described; examples of oscillators using each mode have been presented. A modification of the Miller oscillator using an impedance inverting quarter-wave transmission line, and a method for adjusting the oscillator to true series mode crystal operation and for measuring the crystal dissipation has been given. It has further been shown that the series resonant frequency of a crystal depends only on the crystal itself, while the parallel resonant frequency depends on the capacity placed in parallel with the crystal. ●

F.M. CARPHONES

(Continued from Page 2)

transmitter indicator lamps on the front panel.

This system will allow for the three channels which at present are envisaged and/or operating in Victoria and N.S.W. and we hope other States will adopt these common frequencies as equipment becomes available to them.

F.M. NET FREQUENCIES

The present frequencies and crystals are as follows:—

Two Metre F.M. Nets
(for A.W.A. Carphones, etc.)

	Operating Freq. Mc.	Xtal Freq.* Receiver Kc.	Trans. Kc.
Chan. A	145.854	10,275.3	4,051.5
Chan. B	146.000	10,285.7	4,055.5
Chan. C	146.146	10,296.1	4,059.6

* Crystal requirements are to a tolerance of 0.0025% or better and the stated crystal frequencies are as measured with a load of 30 pF.

When ordering crystals, specify the equipment that it is to operate in.

Present occupation of channels is:—
Victoria . ... A and B
New South Wales A and B

Suggested working arrangements for Victoria as the use of these channels increases:—

Channel A.—General working. Mobile to Mobile, Mobile to Base, Base to Base, but with **preference to general calling and Mobile to Base operation.**

Channel B (main W.I.C.E.N. frequency).—Mobile to Mobile, Mobile to Base, Base to Base, but with **preference to Mobile to Mobile contacts.**

Channel C (second W.I.C.E.N. frequency).—Base to Base, Mobile to Base, Mobile to Mobile, but with **preference to Base to Base contacts.**

All channels may, of course, be used in a real W.I.C.E.N. Emergency, but W.I.C.E.N. exercise traffic will move onto Channels B and C as these come more into use.

Six Metre F.M. Nets

Channel A . . 52.525 Mc. (active)
Channel B .. . . 52.645 Mc. (projected)
Channel C .. .... 52.765 Mc. (projected)

50 Centimetre F.M. Net

435.0 Mc. (active Geelong and Melbourne).

All channels and frequencies use normal 15 kc. deviation and frequencies have been "netted" to the stated frequency by the Melbourne P.M.G. monitoring station at South Morang. ●

☆

Spurious Radiations from Amateur Transmitters

(Continued from Page 9)

(7) VK5RG/VK5ZB, 1964: My 7 Mc. transmission via 70 ohm/300 ohm balun to 7 Mc. folded dipole produced an S8 20 metre harmonic at 400 yards. Using an antenna coupler in place of the all-band balun, the second harmonic was reduced to S3.

Hence I have proved to myself and have had proved to me that it is possible to live with your Ham neighbour. Next time you feel like switching off because yours is all over the place, have a look at your own rig, your own receiver, and then when you are sure your spurious signals are of a reasonable level, approach that neighbour and start up a conversation along these lines and try to convince him there is plenty that he can do to help.

Another big bonus won when lower frequency spurious signals are reduced is the additional chance of escaping b.c.i. complaints. Do you put up ten spots on the b.c. band when operating on 40 metres? Probably nine of them would go if you eliminated the 80 and 20 metre signals you are putting out simultaneously.

CONCLUSION

This is not a complete article in itself, but it is hoped it may spur some to have another look at the problem of spurious signals. It may also inspire some of the more scientific types to write to "A.R." and tell the fraternity just how to do it.

REFERENCES

(1) C.C.I.R. Documents of the 10th Plenary Assembly, Geneva 1963. Volume III. "Monitoring of Emissions".
(2) Report of the Radio Frequency Allocation Review Committee. 12th October, 1961.
(3) Radio Regulations, Geneva 1959.
(4) Handbook for Operators of Radio Stations in the Amateur Service. July 1963.
(5) Wireless Telegraphy Act and Regulations.

JOHN MOYLE MEMORIAL NATIONAL FIELD DAY CONTEST, 1965

Saturday, 6th February, to Sunday, 7th February

DATE

Saturday, 6th February, to Sunday, 7th February, 1965.

DURATION

From 1600 hours E.A.S.T., 6th February, to 1600 hours E.A.S.T., 7th February, 1965.

OBJECTS

The operators of Portable and Mobile Stations within all VK Call Areas will endeavour to contact other Portable/Mobile and Fixed Stations in Australian and Overseas Call Areas.

RULES

1. There shall be five sections in the Contest:—
   (a) Portable/Mobile Transmitting, Phone.
   (b) Portable/Mobile Transmitting, C.W.
   (c) Portable/Mobile Transmitting, Multiple Operators, Open only.
   (d) Fixed Transmitting Stations working Portable/Mobile Stations, Open only.
   (e) Reception of Portable/Mobile Stations.

2. All Australian Amateurs may take part. Mobile or Portable Stations shall be limited to an input of 25 watts to the final stage. This power shall be derived from a self-contained and fully portable source. A Portable/Mobile Station shall not be located within one mile radius from the home(s) of the operator(s), nor be situated in any occupied dwelling or building.

Portable/Mobile Stations may be moved from place to place during the Contest.

No apparatus shall be set up on the site earlier than 24 hours prior to the Contest.

All Amateur bands may be used, but no cross-band operating is permitted.

3. Amateurs may enter for either (a) or (b), or both, in the Portable/Mobile sections.

4. One contact per station for phone and one for c.w. per band is permitted.

5. Entrants must operate within the terms of their licences and in particular observe the regulations with regard to portable operation.

6 Serial numbers consisting of RS or RST report plus three figures commencing with 001 and increasing by one for each successive contact shall be exchanged

6a. Entrants in Section (c) for Multiple Operator Stations can set up separate transmitters to work on different bands at the same time. All such units of a Multiple Operator Station must be located within an area that can be encompassed by a circle not greater than half a mile diameter.

For each transmitter of a Multiple Operator Station a separate log shall be kept with serial numbers starting from 001 and increasing by one for each successive contact. All logs of a Multiple Operator Station shall be submitted by the Operator under whose Call Sign the transmitters are working. No two transmitters of a Multiple Operator Station are permitted to operate on the same band at any time.

7. **Scoring:—**

(a) **Portable/Mobile Stations:**

For contacts with Portable/Mobile Stations outside entrant's Call Area .. .. **15 points**

For contacts with Portable/Mobile Stations within entrant's Call Area .. .. **10 points**

For contacts with Fixed Stations outside the entrant's Call Area .... **5 points**

For contacts with Fixed Stations within the entrant's Call Area .... **2 points**

(b) **Fixed Stations:**

For contacts with Portable/Mobile Stations outside entrant's Call Area .... **15 points**

For contacts with Portable/Mobile Stations within entrant's Call Area .. .. **10 points**

8. The following shall constitute Call Areas: VK1 and VK2 combined, VK3, VK4, VK5 and VK8 combined, VK6, VK7, VK9 and VK0.

9. All logs shall be set out under the following headings: Date/Time (E.A.S.T.), Band, Emission, Call Sign, RST/No. Sent, RST/No. Received, Points Claimed. Contacts must be listed in numerical order.

In addition, there shall be a front sheet showing the following information:—

Name .....Address.....
Call Sign .....Section .....
Call Sign of other operator(s) (if any)
Location of Portable/Mobile Station
From . .....hours to .....hours
From . .....hours to .....hours

A brief description of equipment used, bands used and points claimed, followed by the declaration:

"I hereby certify that I have operated in accordance with the rules and spirit of the Contest."

Signed. ..... Date

10. The right is reserved to disqualify any entrant who, during the Contest, has not observed the Regulations and the Rules of this Contest or who has consistently departed from the accepted code of operating ethics.

11. The decision of the Federal Contest Committee of the Wireless Institute of Australia is final and no disputes will be entered into.

12. Certificates will be awarded to the highest scorer in each Call Areas. Additional Certificates may be issued at the discretion of the F.C.C.

13. **Return of Logs:—**

All entries must be postmarked not later than 7th March, 1965, and be clearly marked "John Moyle Memorial National Field Day Contest, 1965," and addressed to—

Federal Contest Committee, W.I.A.,
Box 638J, G.P.O.,
Brisbane, Queensland.

RECEIVING SECTION

14. This section is open to all Short Wave Listeners in VK Call Areas. The Rules shall be the same as for the Transmitting Stations. Logs shall take the same form as for Transmitting Stations, but will omit the serial number received.

Logs must show the Call Sign of the Station heard, the serial number sent by it, and the Call Sign of the Station being worked.

Only one lot of points can be claimed for any one contact between two stations, for example: VK2AA/P calling VK3XX/P and exchanging numbers. Points can be claimed only for VK-2AA/P working VK3XX/P. No points can be claimed for VK3XX/P working VK2AA/P during this particular contact.

Scoring will be on the same basis as for Transmitting Stations. It will not be sufficient to log a station calling CQ. A station may be logged once only for phone and once for c.w. in each band.

Awards.—Certificates will be awarded for the highest scorer in each Call Area.

☆

IS THIS A RECORD?

(From "Radio ZS", June 1964)

ZS6BCX decided, when well on in his 70s, to take his Amateur licence. This inspired his daughter to follow suit, his son joined in as well. His grand-daughter and her husband refused to be left out, and also took their tests. Now the latter's son (the professor's great grandson) has taken a test to use his parents' rig.

This gives: ZS6BCX, 6BFO, 6BJN, 6BGB, 6BFN and the junior op.—all in one family.

Can anyone top that?

—WIA-L3042

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2. Phone Monitor.
3. Oscillating Detector.
4. Signal Generator.

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0-500 uA.	**31/6**	„ „
0-50 uA.	**45/-**	„ „

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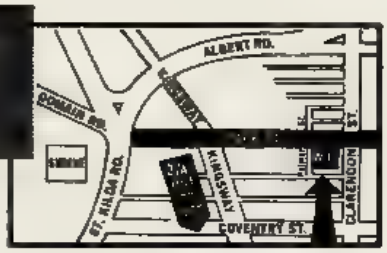

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The Historical Development of Radio Communication

PART ONE—INTRODUCTION

J. R. COX, VK6NJ*

RADIO communication is the modern expression of man's primeval need for communication with his fellows. Throughout the past, human beings have concerned themselves with hastening then extant means of communication.

The main purpose of this thesis is to trace the development of radio communication from its beginning to the present day. It does so by recounting how radio started, has, and still is improving to meet the ever-present need for greater efficiency in the transmission of information

For the purpose of this thesis this search has been divided into:—

1. The era of experimentation.
2. The era of collation
3. The era of formulation.
4. The era of commercial and technical expansion.[1]

It must at once be emphasised that the thesis is not concerned with an attempt to explain the theoretical phenomena of radio, but use has been made of technical data to enhance its meaning. The underlying theme is man's ingenuity in meeting the age-old challenge of communication by devising and improving on what he has thus far produced. Scientists and novices alike have responded to this challenge and the result of their labour, enthusiasm and experiments comes to us in the form of radio communication.

Through the ages, man has utilised a variety of methods to meet his need for communication. The electrical mode is the most recent way and before its advent man depended upon the more obvious media at his disposal. Resources utilised formed three main divisions, namely, physical means, visual means and means of sound. Forming the basis of the first-named section were runners and horsemen. Visual methods, employing the use of light waves, included lighted beacons and semaphore signalling arrangements. When news was transmitted over short ranges the shouted voice and drums, both taking advantage of sound wave radiation, were repeatedly used to good effect.

For over seventeen centuries the methods using physical means, sound and light waves served the purpose of communication well enough, but the pace of communication was slow and the range short. However, as exploration extended frontiers, the dispatch of communications over long distances in a short time became more important. In the closely settled European regions uprisings and the Napoleonic Wars emphasised the advantage of expeditious communication systems. At the same time the limitations of known methods became accentuated and this gave impetus to the investigation of communication systems with a view to improvement in reliability, secrecy, convenience and speed. Central Europe was

* Government School, Yornup, W.A.

[1] See Appendix 1 for chronological development summary sheet.

> • "A.R." has been fortunate to receive from Mr. J. R. Cox a copy of his thesis "The Historical Development of Radio Communication". Due to space limitations, we are publishing the thesis in serial form during the next five or six months.
>
> Although Mr. Cox holds the call sign VK6NJ, no claim is made that the series will be technical, but "A.R." feels that publication is warranted by the interesting nature of what Mr. Cox has written.

the originating point of this work, and it was from there that the notion arose of replacing tried media with a new invisible agent called Galvanic current,[2] now known as electric current. The initial amalgamation of the two—electric current and communication—occurred late in the 18th century and from it has come all our modern communication systems, including wireless.

The emergence of wireless communication from this amalgamation took a hundred years and covers what I have termed the "Collation Era".[3] During this time a long line of primary investigations yielded findings which formed the basic fundamentals upon which wireless operation depended. Hence men who were unaware of the feasibility of wireless equipment, or of wireless communication, assisted its coming. Galvani, Stephen Gray, Oersted and Faraday all belong to this group and are entitled to distinction as pioneers of wireless. Within the period of collation wire telegraphy was established and its growth assisted the development of wireless communication. It did this by providing tested components and technical know-how easily adaptable to wireless systems. Following the successful operation of wire telegraphy, the vision of a **wireless** scheme conjured speculation. In 1865 James Clerk Maxwell foretold the possibilities of electro-magnetic waves if they could be produced His calculations predicted that electro-magnetic waves should be able to be sent over long distances through space. Maxwell's theoretical provision of an invisible connector between two points serves as a concluding mark for the period of collation.

Following Maxwell's postulations came Heinrich Hertz's practical verification of them. Hertz's work ushered in the commencement of the next stage stretching from 1874 to 1896, and which I choose to call the "Formulation Era".[4] This span encompasses the piecing together of the oscillator to generate electro-magnetic waves, the coherer to detect them and the antenna to radiate and collect them. In this period are featured the names of Hertz, Branly, Lodge, Popov and Marconi, the man who arranged these appliances to form the first practical wireless telegraphy system in 1896.

Two years after this Marconi introduced the first successful commercial wireless telegraphy system. From then on, the structure of expansion split into two sections, each paramount to the other, commercial and technical.[5] Companies were floated and the capital financed costly installations and manufacture. Under the patronage of commercial enterprise wireless communication at first developed mainly as a maritime service. Telegraphy messages were flashed from light-houses to Lloyd's of London and often from ship to shore and shore to ship. Naval ships were the first to experiment with ship to ship communication and Admiral Jackson's part in this bears mention.

As range extended, so did the use of radio. Trans-oceanic telegraphic services were inaugurated as were services to places hitherto inaccessible on land. The 1914-18 war was responsible for added demands on radio and wartime contracts for wireless equipment stimulated the industry and accelerated development. The advent of continuous wave transmissions, wireless telephony, aircraft radio and trial broadcasting to troops on the Western Front in 1917 are examples of this.

With the cessation of hostilities came a transfer of these innovations to peacetime use. Sufficient was known, for instance, to begin daily experimental public broadcasts from Konigswusterhausen, Germany, in 1919. In America Presidential election results were broadcast for the first time, in 1920, from Pittsburg. Here in Australia public broadcasting started in Sydney on 23rd November, 1923, when station 2SB commenced transmission from the Smith's Weekly Buildings. Western Australia's first broadcasting station was located in the Westfarmers' Building, Perth. It opened in June 1925 and its call sign was 6WF.[6]

Wireless broadcasting rapidly grew as a dominating factor in communication to the masses. The United States of America, in 1922, had 60,000 homes with a wireless set installed. Eight years after the figure stood at 13,750,000, a gain of over 2,000%, with another prodigious increase of eleven and one-half million by 1950. Australian figures are for the number of licences issues and they also indicate vital growth There were 63,874 licences issued in 1930, 312,192 in 1940, 1,841,211 in 1950.[7] A current estimate of receiving sets in the Commonwealth of Australia places the figure at just under eight million, representing several receivers per

[2] Named after Luigi Galvani, an Italian doctor who discovered current electricity in 1790.

[3] See Appendix 1.

[4] See Appendix 1.

[5] See Appendix 1.

[6] This information came from the 1925 Westralian Farmers Limited Handbook and Mr W. E. Coxon, a departmental manager of that firm in 1925. He now resides at 11 Lapsley Road Claremont

[7] Australia, Tariff Board Report on Radio and Television Equipment· 1959.

household and just under one receiver per person.[a] The world total of wireless receivers was surmised to be 350 million in 1957, and this figure, for the first time in history, exceeded the estimated daily newspaper circulation of 250 million. From an audience of a few in 1896 to 350 million in just under seventy years is a staggering truth.[a] There is no reason to believe that this is the ultimate. The coming of the transistor has, and still will, increase the accessibility of wireless communication.

APPENDIX 1

CHRONOLOGICAL DEVELOPMENT OF WIRELESS COMMUNICATION

The Era of Experimentation:

To 1700 — The period of mounted messengers, vocal relays and visual means—torches, beacons.

The Era of Collation:

1729—Gray—establishment of electrical conductivity.
1789—Chappe—visual semaphore bar system. Von Sommering introduced electrical current as a means of signalling.
1820—Oersted established connection between electric current flow and magnetic field.
1831—Faraday discovered electro-magnetic induction.
1833—Gauss—first successful two-wire electric telegraph.
1838—Steinheil replaced one wire by using earth as a return path. First successful one-wire telegraph.
1840—Morse introduced his code and key to send and receive wire telegraphy messages. This system of long distance communication made possible by magnetic relays working on principles of Oersted's and Faraday's findings.
1865—Maxwell mathematically explained Faraday's experimental findings. Prophesied electro-magnetic wave production and gave science a new means of regarding electrical phenomena.

The Era of Formulation:

1876—Bell introduced microphone and earpiece. First transmission of speech over wires.
1888—Hertz fabricated an oscillator to generate electro-magnetic waves and established, by experiment, veracity of Maxwell's thesis.
1890—Branly used a coherer to detect Hertzian waves.

The Era of Commercial and Technical Expansion

The Period of the Spark-Gap Transmitter

1896—Popov used a long wire to detect natural electrical magnetic disturbances.
1896—Marconi patented first practical wireless system. Gained longer range by using elevated wires as a transmitting antenna.
1896—First commercial wireless telegraph.
1899—First trans-Channel transmission.
1901—First trans-Atlantic transmission.

The Thermionic Valve Period

1904—Fleming—first thermionic valve. The two-element "Ionised Gas Detector".
1906—De Forest inserted the grid. First thermionic valve capable of amplification: "The Audion". Braun introduced out-of-phase excitation to give directivity to antenna. Dunwoody discovered crystal detector.
1913—De Forest, Langmuir, Hogan, Meissner introduced principle of self-oscillation and regenerative amplification using a triode valve.
1916—General Electric Co. inserted fourth element to valve for use in wireless telephony.
1917—Experimental broadcasts, Germany.
1918—Armstrong introduced heterodyne circuitry.
1919—Experimental broadcasts, U.S.A.
1921—First successful two-way trans-Atlantic wireless transmission using short waves.
1925—Appleton proved existence of ionospheric reflecting layers.
1933—Tuve and Breit evolved pulse method of determining reflecting layer heights. Yagi pronounced multi-element theory for gaining true beam effect.
1933—Armstrong concluded experiments on frequency modulation with the perfection of a satisfactory system which eliminated static.

The Transistor Period

1948—Shockley, Brattain, Bardeen introduced the transistor.
1958—Modular concept programme commenced in U.S.A.

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YOUTH RADIO CLUBS

Boy Scout Jamboree-on-the-Air created a great deal of interest and many hundreds of Scouts were on the air—a fine thing this, and everybody should support it. Amateur Radio, with field days and communication between groups, seems to fit perfectly with the work of the Scouts. There is a rich field here for those who can make the contact.

Most news this month is from VK2 and VK3—thanks to their Newsletters. Have heard indirectly that there is a VK5 Newsletter but am not favoured yet.

The feature story, as you might say, is the interesting idea at Westlakes where Keith 2AKX and associates in the flourishing new club (membership now 48) are conducting a series of half-hour discussions between two stations, the first series on "Electricity and Magnetism," intended to serve as instruction for beginners. The frequency chosen is 1815 kc, so that any ordinary receiver can be quickly modified, and duplicated lecture notes and diagrams are available. This has great possibilities, and all interested in Youth Radio instruction should give serious thought to this.

Other VK2 news: Don 9DR gave a very interesting illustrated talk to VK2 Division meeting and showed much Y.R.S. work on Christmas Island. Ian Hopkins, of Illawarra Y.R.C., advises that the club has new quarters and the club station is on the way. Also, Charles Hoyer, of Unanderra, is taking part in the Duke of Edinburgh's Award and is making good progress. Graeme 2GJ has started a transmitting club with Kyogle Scouts with worth while publicity in local papers. Ian Guy, a teacher at North Sydney Boys' High has started a radio club and will probably try for his own A.O.C.P. Terry Crews, formerly of Gosford High, and Graeme Dennes, formerly of Taree High, have gained L.A.O.C.P. as radio apprentices with R.A.A.F. Radio School at Laverton (Vic.) Wal Bray, teacher at Canterbury High, has passed L.A.O.C.P.

Four Elem. Cert. at Inverell High—Bruce Thompson, Andrew Hemus, John Liston and Andrew Jackson. In all VK2, 13 Junior Certificates so far, one Inter., but no Senior, although 16 have jumped to A.O.C.P. 2YA and 2AVV are on the air each Tuesday at 4.30 p.m. on 40 metres with Y.R.S. information and competitions—all welcome. Vacation course for teachers on "Electronics in School Science" organised by Dept. of Education. Jacoby Mitchell, of Sydney, already employ Roger Blakey, formerly of Kingsgrove High, and are seeking another Y.R.S. graduate. Good vacancies in R.A.A.F. Radio Apprenticeship Scheme and in Dept. of Civil Aviation. "Careers Night" is being organised by Standard Telephones and Cables at their Alexandria works to attract Y.R.S. types. A simple tip for club leaders—one old i.f. transformer (iron dust cored) makes two inductive tuning units, when cut in half and usual 100 pF. capacitor in parallel replaced by about 300 pF. with possible reduction of turns in coil.

VK3 news: Macleod Radio Club leader, Ron Salter has affiliated, also Yallourn Technical College, leader Dave Godfrey. Five girls from St. Anne's C.E.G.G.S. at Sale have passed Elementary—Bronwyn Robert, Anne Martin, Kathleen Byatt, Sharyn Budge, Barbara Knight—congrats. from all the boys to these girls. Graeme Orr, secretary of Warrnambool Tech. College Club, has persuaded a teacher (Mr. Hall) to help the club along. Eleven elementaries at Bundoora—Nicholas Cecic, Tim Daniels, John Coulter, Murray Enniss, Bernard Egan, Michael Gurry, Paul Healy John Lowes, Alan Noyes, Geoff Sims, Kevin Gierney—their science master (Mr. M. O'Brien) is pleased at the profit. Secretary Geoff Nicol tells of Y.R.S. exhibition of gear at Greythorn High with many questions from parents. New club at Camberwell High, 15 students with instructor Mr. R. J. Hurle.

No direct news from "Uncle Charlie" in VK4 but you can be sure that Hive-wire Chas. is on the job. However, it's a very busy time in the schools just now because all important exams. such as Leaving Certificate and others are being held. Best wishes to our many members who are, I am sure, going to distinguish themselves, at least in the electronics department. 73, Ken 1KM.

[a] "Radio, Television and Hobbies," Sungravure Pty. Ltd., Rosebery, Aust.; Vol. 25, No. 8, November 1963, p.1

[a] Gartmann, H. "Science as History," Hodder and Stoughton, London, 1960.

NEW CALL SIGNS

AUGUST, 1964

VK1KW—A. H. Vonthethoff, 32 Rivett St., Hackett, A.C.T.
VK1QL—J. Weatherley, 25 Millen St., Hughes, A.C.T.
VK1US—P. R. O'Connor, 33 Colvin St., Hughes, A.C.T.
VK2ZJ—G. Kempton, 44 Robinson St., Kogarah.
VK2AGI—A. J. Jones, 10 McAlister Ave., Engadine.
VK2ATG—Kuringai Civil Defence Radio Club, Station Kuringai Council Chambers, Gordon, Postal: 8 Braeside St. Wahroonga.
VK2AYD—D. G. Taylor (Sig.), C/o. 301 Sig. Sqdn., 11 Gormley St., Lidcombe.
VK2BCF—D. Searcy, 23 Government Rd., Beacon Hill.
VK2BSA—Boy Scouts' Assn. (N.S.W Branch), Station: Baden-Powell War Memorial Camp, Pomona St., Pennant Hills, Postal, 255 George St., Sydney.
VK2BSC—H. D. Russell, 14 Moulden St., Speers Point.
VK2ZEF—R. E. Birley, 24 Goodchap Rd., Chatswood.
VK2ZMG—M. J. Garth, "Damaka," 36 Chester Rd., Ingleburn.
VK2ZPQ—J. A. Gardner, 4 Tobruk Ave., Allambie Heights.
VK2ZWL—J. P. Lowe, 1 Dunbar Close, Normanhurst.
VK3FP—K. A. Jaya, 14 Second St., Mentone.
VK3OW—I. Tarbit, 19 Rosedale Rd., Glen Iris.
VK3ZCR—B. J. Alsop, 78 Dunblane Rd., Noble Park.
VK3ZDD—J. R. Torrington, 4 Thistle St., Pascoe Vale South.
VK3ZDF—P. Garde, 164 East Boundary Rd., East Bentleigh.
VK3ZFB—D. T. Bellair, 1 Mossman Drive, Heidelberg.
VK3ZIF—I. E. Stribling, Station: Armytage St., Lorne; Postal: 80 Cromwell Rd., South Yarra.
VK3ZJD—W. J. Darragh, 3 Freeman St., South Caulfield.
VK3ZKO—R. K. Von Sanden, 18 Parkside St., Malvern.
VK3ZLF—A. J. Jenkins, 317 Burwood Rd., East Burwood.
VK3ZSJ—B. K. Martin, 3a Shafton St., Huntingdale.
VK3ZTN—D. E. Stacpoole, 15 May St., Hamilton.
VK3ZWB—R. W. Bruce, 15 Tiller St., East Burwood.
VK3ZXH—M. F. Hayes, 14 Anderson Ave., East Ormond.
VK3ZZZ—D. G. Bills-Thompson, 6 Fairmount Rd., Hawthorn East.
VK4AK—D. D. Tanner, C/o. Mt. Isa Mines Ltd., Mt. Isa.
VK4BH—H. G. Brown, 29 Fraser St., Graceville.
VK4CC—G. A. Campbell, 33 Seaside Ave., Mermaid Beach.
VK4KN—K. G. Avery, 41 Brisbane Rd., Ebby Vale.
VK4MY—D. C. McDonald, 10 26th Ave., Palm Beach.
VK5DL—T. P. Drake, 13 Lindley Rd., Greenacres.
VK5MU—A. J. Pfitzner, 6 Bond St., Norwood.
VK5SR—S. Rae, 90 Halsey Rd., Elizabeth East.
VK6XG—G. N. Antuar, 40 Main St., Peterborough.
VK6JC—B. J. Coles, 22 London St., Mt. Hawthorn.
VK6NN—D. Ross, 48 Norma Rd., Alfred Cove.
VK6VW—R. B. Pemberton, 230 Jersey St., Wembley.
VK6WY—W. G. Wylks, 22 Margaret St., Cottesloe.
VK6XX—I. Kauler, Station: Narrogin Valley Rd., Narrogin, Postal C/o. 6NA, Narrogin.
VK6ZAC—J. F. Chambers, 4 Lena St., Tuart Hill.
VK8NM—M. S. Lang, 4 Lambell Tce., Darwin.
VK9ZJD—B. J. Dodwell, Station Vai Vai Ave., Boroko; Postal: P.O. Box 110, Port Moresby, T.P.N.G.

From Our Reading

"QST," September 1964

An interesting issue containing articles about a small five-band, transistorised converter for use in conjunction with a standard b.c. transistor set; the problems of increasing transmitter power in v.h.f. stations, with several suggestions, a stable, transistorised, heterodyne v.f.o. with output in the 160, 80, 40, and 20 metre bands, constructional details of Monmatch Mark III. and Mark IV.; the effect on directional patterns of tilted verticals; the use of 15 and 20 metre antennae on 80 and 40 metres; an unusual electronic keyer using a neon bulb relaxation oscillator as the timing element; and a description of a phase-lock detection method suitable for satellite or moon-bounce communication.

"CQ," September 1964

Apart from the usual monthly columns, this issue contains articles about a 6 metre J antena; neat packaging of a complete Ham station; modifications to the Collins 75S-1 receiver; a computer like push-button electronic keyer; part two of the series on Lasers; part two of R.t.t.y. from A to Z; and an interesting review of the Heathkit SB-300 receiver.

"Break In," September 1964

A three-band minibeam, called the VK6 Joybeam, is described in detail, and part 10 of the Receiver Series discusses noise limiters and S meters.

R.S.G.B. "Bulletin," September 1964

The first article deals effectively with a transistor pre-amplifier, includ. diode clipping, for use as a speech amplifier; and others include a description of a light-weight aerial feeder; a simple converter for 70 Mc.; and notes on the G2DAF s.s.b. receiver. Technical Topics deals, amongst other things, with silicon controlled rectifiers, tunnel diodes, a multiband dipole, transistor transmitters, and a transistor speech compressor.

R.C.A. "Ham Tips," Summer 1964

This issue details an interesting and unusual approach to a low cost, high efficiency, plate and screen modulator with an output of 50 watts.

"Short Wave Magazine," Sept. 1964

A number of interesting articles in this issue include a mobile/portable 2 metre transmitter using a transistor modulator; a simplified electronic keyer; a sensitive r.f. monitoring unit; part five of the series on the practical applications of semiconductors in the Amateur station; modification of an L-F band transmitter for the H-F bands; and a design for a ten-watt modulator with a restricted frequency response.

New Kind of Convention

The New South Wales V.h.f. and T.v. Group will hold their first Three-Day V.h.f. Convention on **5th, 6th** and **7th March, 1965.** The programme will commence at 8 p.m. on Friday 5th at WI Centre, Crow's Nest. Bookings for accommodation can be arranged if desired. Programme and venue will follow in future issues.

TECHNICAL ARTICLES

Readers are requested to submit articles for publication in "A.R.," in particular constructional articles, photographs of stations and gear, together with articles suitable for beginners, are required.

Correspondence

Any opinion expressed under this heading is the individual opinion of the writer and does not necessarily coincide with that of the publishers.

JOHN MOYLE NATIONAL FIELD DAY CONTEST

Editor "A.R.," Dear Sir,

For some while now, the subject of how the Moorabbin and District Radio Club should participate in the multi-operator section of the John Moyle National Field Day Memorial Contest has been discussed among members.

These discussions culminated in a policy being determined at the Club's general meeting of 15th May, 1964.

We would like to use your correspondence columns to publicise this policy as it will affect Moorabbin members in field events over the next few years.

Since the 1961 National Field Day at least top honours in the multi-operator section have gone either to the Elizabeth Club VK5LZ or the Moorabbin Club VK3APC. During this period, we at Moorabbin, have viewed with some alarm the steady reduction in the number of small multi-operator groups competing.

We think this may in part be due to the growth of a feeling that the section has become the perogative of the large clubs. We have reached the conclusion, therefore, that in the best interests of the Amateur Service, the Moorabbin Club will, for a period, not compete as a club station.

Rather it will promote the entry of three or four smaller groups, each operating independently of the other, under the call sign of one of the group members, with each trying equally hard to gain the highest score.

As an added incentive, the club will donate a cup, to be known as the "Moorabbin Cup" to that group of its members attaining the highest score in the contest.

By these actions we hope to achieve the following objectives:—

1. Directly increase the number of multi-operator groups taking part.
2. Indirectly increase the number of groups by minimising the feeling—if it exists—that membership of a large and virile group is mandatory to success.
3. Promote the construction of a greater variety of portable/mobile equipment that could be used in times of emergency.
4. Give opportunities for organisation and operating to a greater number of club members.

All four of these aims are, we feel, those of Field Day Contests themselves, i.e. to provide a pool of operators and equipment that can be used in times of emergency. We feel that our best defence in the fight to regain lost frequencies—or even just to keep what we have—is to be able to render some public service. Emergency work of any kind is the best way to do this.

—Harold L. Hepburn, VK3AFQ, Secretary, Moorabbin and District Radio Club.

JAMBOREE-ON-THE-AIR

Editor "A.R.," Dear Sir,

I have before me my copy of "Amateur Radio" (October issue) and am delighted to see that you were able to use the block we sent along for the front cover of your very good magazine. At the same time I should like to thank you for the very excellent editorial which I feel went a long way towards helping make this year's Jamboree-on-the-Air such a successful venture.

Each year the Boy Scouts' Association is deeply indebted to the Amateur Radio movement, particularly the members of the Wireless Institute of Australia who rally to our call and without whom Jamboree-on-the-Air would just not be possible. Each year also, through this excellent journal, the Jamboree is given wide publicity and this year has been no exception.

I should like to take this opportunity, therefore, on behalf of the Australian Boy Scouts' Association and the many Cubs, Scouts, Senior Scouts, Rovers and their Scouters who gained so much enjoyment from the Jamboree-on-the-Air, of expressing our deepest and most sincere thanks. Thank you then, from our Chief Commissioner (Mr. C. R. Nichols) down to our humblest Cub. May we continue to enjoy this most happy association.

—Noel Lynch, National Organiser, Jamboree-on-the-Air

CO-OPERATION

Editor "A.R.," Dear Sir,

During the month I received a letter from Bryan Prosser, L8038, who wrote on behalf of two keen S.w.l's in his area. These lads, 17 and 18 years of age, have been in wheelchairs for the past seven years, and up until June of this year were using an antiquated set for their listening. A lady of Claremont, in W.A., generously gave them a very nice receiver, but the lads found that, owing to their position, could not have easy access to the controls. Members of the W.I.A., W.A. Division, came and took the set away, cut the cabinet to size, completely overhauled the set, and returned it to the lads. Now the boys, who, by the way at that time were not members of the W.I.A., have been set up and can really enjoy our hobby. These lads have since joined as associate members.

This spirit of co-operation is a great inspiration to associate members, and is prevalent not only in W.I.A., but also in other States, as each month I hear of some S.w.l. who has had assistance from fellow members.

Recently I placed a request in the VK2 monthly "Bulletin" for a receiver for a junior S.w.l. A Mr. Adams of Toukley, some 70 miles from my QTH, kindly offered to give, and rail the set to me. I informed Mr Adams that I was going to Newcastle, so he personally took the set to the address to where I was going, which was about 30 miles from his QTH.

No doubt many of our members could tell of such help, but I felt that I must let these two fine gestures be made known.

—Chas. Abernethy, L3211.

DX

VP4, OA4, BV, ZM7, 7GI, FP, AC5, MP4, ZC6, TY2

Sub-Editor. H. A. BEHENNA, VK5BB,
14 Stanley Street, Crystal Brook, South Aus.
ADDRESS CORRESPONDENCE FOR THIS PAGE DIRECT TO THE SUB-EDITOR

Over the past month or so, the bands have shown a decided improvement, DX-wise. While there are more openings to the various parts of the world, there is, however, the erratic nature of each band. One never ceases to wonder just what he will hear next and from where it will come. Listening is still the ace key to getting the results! With good operating and good clean signals, you will become popular on the bands and will be sought after.

Activity on 14 Mc. seems to indicate that this band is still the old reliable, but 7 Mc. seems to be gaining in popularity from many of the boys, whilst 3.5 Mc. is showing some promise on occasions. 21 Mc. is either open wide or closed, and it's a bit hard to follow its habits. It takes a contest to show whether these bands are workable or not. During the recent contest a tune over 14 Mc., during the pre-lunch period or around midday local time, the following stations were heard. VU, AP, JA, KG, KW, HL, 9M, HM, 3W8, VK0, KC4, ZL, VR, KC, KX, KR, etc. On any normal day, about the only thing one can hear is VK or ZL. This undoubtedly proves that it is lack of activity rather than bad band conditions.

ACTIVITIES

3.5 Mc. is now proving its worth for those who would like to give this band a go, especially around 1200z, on various evenings one can hear the South Americans, Peru, Columbia and most of the U.S. areas.

YN1AA, of Managua, Nicaragua, on this band seems to attract a lot of attention, but he is always busy working break-in traffic on high speed Morse.

The A.R.R.L. announce a further addition to their D.X.C.C. Countries List with the Saudi Arabia/Iraq Neutral Zone. Operation from this Zone is taking place from this area with the prefix of 8Z4.

HM2BD reports that he is the only HM2 who has a permit to operate on 14 Mc. s.s.b. For QSL P.O. Box 8, Sosa, Korea.

UB5UN had a visitor in the shack, namely Bob W6NRB/UB5, who is with the American Exhibition at Kiev. They are very active, and around Xmas are moving to Moscow, and will become /UA3.

K5CDA/MM is on the S.S. Cathy, which is cruising in Far East waters.

VS6FH and VS6FJ, at Hong Kong, had their vertical antennae both brought down by the typhoon "Viola".

UW1KAE is a good one to catch, as he is on Franz Josef Land. Reported to be using a frequency of 7020 kc. app. 2300z.

VQ1GDW, operated by K1IGO, is the only station in Zanzibar, and says there are no prospects of new calls for some time.

Jack KW6EJ calls CQ most nights on s.s.b. at 14250 kc., app. 1030z.

Wally W6BHM is by far the most consistent from the States on 21 Mc. on the high end on s.s.b. If Wally is on you can hear him around 0200z.

W9TQY, of Winfield, is back on the air after some years of lay-off, and is enjoying catching up on the "tube type" prefixes.

ZS1PP on 14 Mc. phone has worked a number of our members, and is the call of John Barnard, located at Cape Province, Republic of South Africa. He runs a Geloso, 6146 and a cubical quad antenna.

Charles Thorpe, L4018, reports hearing JA-1GHV calling CQ on 28 Mc. s.s.b. He was 5 by 5. Time 0330z, no contact was made.

Quite a pile up was caused by Archie VQ8R when he answered a CQ from a VK on 14 Mc. at about 0530z, works s.s.b.

Crozet, FB8WW. 14 and 7 Mc., a.m., s.s.b.
Campbell, ZL4JF. 7 and 14 Mc.
Amsterdam Is., FB8ZZ. 7 and 14 Mc.
Norfolk Is., VK9RB. 14 Mc.
Amer. Samoa, KS6BL: 14 Mc., A1, 0600z.
Marcus Is., KG6IF. 14250 kc. s.s.b., 1500z.
Nepal, 9N1MM. 14 Mc. A1, s.s.b. 1000z.
Muscat, MP4MAH. 14 Mc. A1, s.s.b., 1000z.
Oman, VS8OC. 14295 kc., 1900z.
Trucial Oman, MP4QBF/MP4T. heard on 7 Mc., 2000z.
Saipan, KG6BZ.
Congo, 9Q5AB. No frequency available.
Bechuanaland, ZS9A. 14 Mc. s.s.b. One year's operation.
Liberia, EL2F. 14 Mc. s.s.b., 1800z.
India, VU2GV: 14 Mc.
Cameroons, TJ1AC. 14 Mc. s.s.b.; also active is TJ8AL.
Singapore, 9M4ME: 7 and 14 Mc.
Tadzhik, UJ8KAA.
Falklands, VP8HJ: 14 Mc. s.s.b., 0800z.
Yemen. 4W1E. 14 Mc. s.s.b., also 4W1F on 7005 kc. 2000z.
ZL1ABZ QRT in November.

Ex-VK Rex Vidicombe, is now EL2F on 14280 kc. s.s.b., running 1kw. in Liberia.

TR8AD, Max, is on from Gabon around 14040-50 kc., 22-2300z. QSL to Box 1625, Libreville, Gabon Republic.

LU1ZC is operating from Deception Is. in the South Shetlands. His usual frequency is 14048 c.w. and he's been heard both at 0300 and 1200z.

FB8WW was heard at 1200z operating on both 14045, listening up 3, with a beam heading of 330 degrees.

Ascension, ZD8BB. A DX40 has been sent to him to replace a borrowed rig. Op's name is Ray, QSL via W7ZMD. Also active is ZD8WR, reported on 21 Mc. s.s.b. about 1830z.

Easter Is.: C.w. and s.s.b. operations scheduled to start about Dec. 1, possibly late Nov. Bands 80-15 and possibly 10. Using Hallicrafters gear and Hy-gain beam. Anticipated freqs. are c.w. 3503, 7003, 14002, 21002; s.s.b. 7097, 14128, 21400 (listen as directed). On last trip to Juan Fernandez, 15 mx was open for longer periods than 20, and reports are that this will again be the case. So advice is watch 15 closely, particularly on Saturday and Sunday, 1700-1900z. Operators are Ed Cushing (W4QVJ) and Bill Eitel (W6UFI). QSL via W4QVJ, Box 3045, Jacksonville, Florida 32211. GMT, s.s.s.e. (I.R.C.).

The world's greatest DX-peditioner, now known all over as Sir Gus, W6BPD, is reported ready to leave for Asia, and hopes to be active with several prefixes, viz. JY, ZC3, YI, YA, 9K2, etc.

Don Reed, VK9DR, Radio Officer at Christmas Island, left Melbourne 19th Nov. with his XYL to return to his 64-square mile dot in the Indian Ocean. Don expects to be active only on c.w. until late in December when he expects to receive his sideband tx back from VK3. During his leave in Australia, Don and XYL visited VK2, 3 and 4. He will be on Christmas Island until mid 1966.

STATIONS, COUNTRIES AND [illegible]

From John VK5LV: 14 Mc. s.s.b., JA2API/MM, OH1NA, VU2WZ, KA9MP, 4S7TL, 9M2AF, 11ZJG, JA2AJV, KR6BP, HC3JI, YV4CI, Wa.

From this QTH: KC6BK, KG6APJ, HM1AX, 9M4JW, HC5EJ, KH6BV8, ZL1AH, HC3LDA, VQ8R, KA2RG, YV5BQF, YV1LA, Ks, Ws, KR8FY, UB5UN, KW6EB, KA8JM, DU1KH, XR1ES. K7LMU/3W8—all on s.s.b. 14 Mc.

There appears to be some confusion regarding the QSL of K7LMU/3W8. Please take note that you QSL to K6EVR and not K6ERV. The correct address is Ron Camp, 9961 E. Estrella Avenue, Temple City, California, U.S.A.

From David VK3QV, reports of 21 Mc: Bad noise at his QTH whilst beaming to Europe and is causing him some concern and makes for tough going. However he has worked the following: s.s.b. HC3JT, HC2ALT, HM5CO, JA1-7, KA2LD, KH6JQ, KH6FAH, KJ6BZ, KR6AF, KR6BF, KR6FY, KR6OJ, KZ5AW, W/K 3-6, XW8AL, 9M2LO, 9M4LP, 9M4LX, K7LMU/3W8. Also some JA and DU1MR on a.m. Phone heard but not worked W1MGX, GI3JIM, SV0VW, 9J2AS, XE1FFV, WA2SZP. Quite a while since the East Coast has been heard. Whilst on c.w. CR9AH, DL3JJ, HM5CO, JA1-3-6 9-0, W/K 4 and 6. The ones that got away, SP9RF, VS6FC. Thanks David.

From the QTH of Ken VK3TL. Africa is really coming through on 40 and 20. GB3RSS is the Scout station in England. Don has really been knocking them off from Cambodia and Vietnam. Ken reports working on 20 c.w., CR6GO, EP2AS, HM1BB, HZ3TYQ, IT1AQ, OD5LX, VQ2DT, W9WNV, XU, PZ1AA, ZS3HT. 20 mx phone CE3ZQ, CN8GB, CR6E1, EP2AU, EP2BQ, GB3RSS, HI8WSR, HM1AX, HP1MN, HS1I, OZ9Z, PJ2AA, ZS3HT, K7LMU/3W8, 5Z4AA. 40 mx 5R8AB. Ken's best QSLs for the month: 3A2CP, 9M4JW, VQ4IQ, VS5LX, CR6GO, HR1RP, PY5ASN, PY3APH, HI8WSR, ZS3HT (S.W. Africa).

A late report from Ken on the air—he has heard that 28 Mc. has been open from PA8 to South America, also to South Africa to PA8 on occasions. From 2nd January, 1965, to 30th January, 1965, Ken will be operating from Norfolk Island under the call sign of VK9TL. Transmission on c.w. and s.s.b. will be forthcoming on 40 and 20 mx, and an eye kept on the 15 mx band and will be used if the band decides to show any life, which I think it will. Good hunting Ken, I hope to work you there. All QSL activity will come from his home QTH at Smiths Road, Templestowe, Vic. Thanks for dope, Ken.

From Pete VK5FM—some of the better ones worked: ON5ZO, 9M4LD, LZ1KPW, KC4USS, UR2KAA, G2BSA, G3LB, HC2FN (0830z), 4X4TP (LP), TI2SS, HK5AOH, PY2AHJ, LA-9CE, HC1BM, HS1S, Ws, Ks, etc., all on 14 Mc. s.s.b.

A letter from Colin VR4CB tells of a forced stay in VK4, a lapse in hospital, and an operation. However news is good. He will be making a tour southwards and calling here on 11th December. Will be nice to see you.

KG6SV is on from 0830z and puts in a good signal.

KX6AJ is now back in the States under his own call W6GRZ.

QTHs OF INTEREST

HZ3TYQ—Box 1731, Aramco, Dhahran.
W8WNV—Via K6EVR.
HP1MN—P.O. Box 3195, Panama City.
HI8WSR—P.O. Box 1367, Santo Domingo.
CR6GO—P.O. Box 10408, Launda, Angola.
CR6E1—P.O. Box 74, Benguela, Angola.
HM1AX—Via WB6GVV
K7LMU/3W8—Via K6EVR (check elsewhere, this page)
VQ8R—Archie Parkhouse, P.O. Box 99, Mbabane, Swaziland.

Stan KX6BK is making the journey south to VK6 for the moment and hopes to visit the mainland a little later on.

A few of the W stations have only a few countries to go to have worked the lot. A rumour says that operation from these last remaining countries may be forthcoming soon as at present there is little or no activity from these remaining countries.

A parting word of thanks to those that sent in any notes this month. To the following names and call signs it is a pleasure to do business with them: Ken 3TL, Al 4SS, David 3QV, John 5LV 73, Bert VK5BB.

W.I.A. D.X.C.C.

Listed below are the highest twelve members in each section. New members and those whose totals have been amended will also be shown.

PHONE

Call	Cer. No.	C'nt-ries	Call	Cer. No.	C'nt-ries
VK5MS	24	308	VK3JZ	81	317
VK6RU	2	303	VK6KW	4	311
VK5AB	45	301	VK3WL	14	311
VK6MK	43	293	VK3ATN	36	304
VK3AHO	51	288	VK4HR	13	182
VK4FJ	21	280	VK4RW	33	186

C.W.

Call	Cer No.	C'nt-ries	Call	Cer. No.	C'nt-ries
VK3KB	10	326	VK6RU	18	260
VK3CX	26	304	VK3AHQ	79	246
VK3QL	5	301	VK3ARX	66	243
VK4FJ	39	290	VK3KB	75	238
VK3NC	10	286	VK3YL	39	237
VK2AGH	71	267	VK2EO	3	234

OPEN

Call	Cer No.	C'nt-ries	Call	Cer No.	C'nt-ries
VK6RU	8	308	VK3NC	77	287
VK4FJ	32	305	VK3HG	3	274
VK2ACX	6	300	VK3JA	43	252
VK2AGH	83	300	VK1L2	23	242
VK6MK	74	295	VK2VN	18	236
VK3AHO	76	294	VK4HR	7	233

VHF

52 – 144 – 420 – 576 – 1296 Mc.

Sub-Editor: LEN POYNTER, VK3ZGP,
14 Esther Court, Fawkner, N.15, Victoria
ADDRESS CORRESPONDENCE FOR THIS PAGE DIRECT TO THE SUB-EDITOR

I would like to take this opportunity of thanking all those who have contributed to the support of this page each month and trust that they will continue on with the good work in 1965. Our correspondent in VK5 has been missing for quite a few months. We hope that having taken out his "Full" certificate he isn't lost to our ranks. Our usual full cover is missing without the VK5 notes, so hope someone will step into the breach and keep it up to date with the VK5 activity.

As can be seen in the VK4 notes, Channel 0 No. 2 is under way and by next winter our VK4 friends will be experiencing some of the problems that the VK3 boys have had for the past few months. George 4ZLG in Melbourne at the time of writing, will no doubt take a mental picture of the problems and also quite a few of the cures back with him. Geo. has seen some of our net activity and we hope was suitably impressed.

With these few words, I pass on to each and everyone all the best of health, happiness and DX for Christmas and for the coming year of 1965. Although there will be no notes in the February issue, keep the reports coming in. 73, best of DX, 3ZGP (P.S.—If in Melbourne over Christmas ring 35-6677 for six-penny-worth.)

NEW SOUTH WALES

52 Mc.: Activity is increasing rapidly as more stations move to this band for the DX season.

144 Mc.: Activity good with several new stations on the band.

432 Mc.: A few stations active. 2ZCF relays the v.h.f. news broadcast on 432 Mc.

VK2 Beacon: A 2 metre beacon in the form of ABWN-3A is in operation. Sound is on 143.75 Mc. The station is located 13 miles south of Wollongong at 2,000 feet.

2WI is once again on the 52 Mc. band, with a frequency of 53.266 and output of 40 watts.

David 2ZXW and Phil 2ZPI will be operating from Mt. Kosciusko from early morning on Friday, 1st January, to Sunday, 3rd January. They will be on 144.045 and 52 Mc. Stations wishing to contact them should not operate in the first 200 kc. of 2 metre due to local interference. Best time for DX appears to be around 6 a.m.

A new type of event known as a Twilight Fox Hunt is being tried. This event consists of two fox hunts starting late afternoon, separated by a barbecue tea. This should allow persons unable to attend a full day or night event to participate.

Canberra News (from John 1ZRX): Only three stations active on v.h.f. They are 1CR, 1VP and 1ZRX. 1VP has 80w on 52 and 144 Mc. and a 4/20 final on 432 and 144 s.s.b. Aerials consist of a 32 el. on 144, 4 el. on 52, and a 432 beam is under construction. 1ZRX is on 52 and 144 Mc with a 3 el. beam on 52. All three active stations have gear for Oscar 3.

North Coast Little news, stations active are: From Grafton 4WQ, 2OE, 2NY and 2TV; Bellingen 2ZCQ, Lismore 2ZFS and 2KA. They are all near the lower edge of 144 Mc.

V.h.f. Field Day. This will be held during March with many v.h.f. events. 73, 2ZPI.

VICTORIA

Band News: 6 metres has been very active over the past month. There are about 40 active stations on the 53.033 Mc. net. Two metres has been active, but has slowed down due to examinations which started at the beginning of November. There was a brief opening to Mt. Gambier at the end of October 432 Mc. is still active and more stations are appearing on this band each week. John 3ZOQ reported that he heard the VK5 6 mx beacon on Monday, 12th Oct. at 3.30 p.m. E.A.S.T. Cyril 3ZCK heard a weak carrier on 53.00 Mc at 5 p.m. the same day. This signal peaked to the west. Dave 3ZOD at Hamilton is active on 2 mx on 144.65 or 144.30 each evening and listens for Melbourne and Mt Gambier stations.

VK3 V.h.f. Convention: The VK3 Division's V.h.f. Group held its first annual Convention on 11th and 12th Oct. at Perny Creek in the Dandenongs. About 50 Amateurs from VK3, VK3 and VK5 attended, together with some 3 or 5 S.w.l's and many YLs and XYLs complete with harmonics. The Convention started with an eyeball QSO on Saturday afternoon, followed by a barbecue tea where many chops and sausages were cooked?? or eaten?? complete with ashes and cinders. After tea everybody adjourned to GTVF's tx station at Mt Dandenong where the engineers on duty gave a very interesting talk on the operation of the station.

On the Sunday many more people attended and great fun was had by all. Events included a 2 mx scramble (won by 3ZNC), 3ZGF sold some disposals gear, and a hidden tx hunt. What a hunt? A Melbourne station was running the full gallon on the same frequency and was stronger than the hidden tx. No wonder, it was buried 5 feet down, half way up a 30 ft. cliff! with about a mile of coax connecting it to the antenna, which was at the top of a tall tree. It was eventually found by a VK3, ably assisted by 3ZNC, who was using a portable t.v. set on channel 5A as a snooper. After this everybody returned to Ferny Creek for afternoon tea, supplied by the ladies. Then all said their farewells and departed for home with ideas for making our next Convention bigger and better than the first.

V.h.f. Field Days: The VK3 Division's v.h.f. field day season commenced on Sunday, 25th October and will continue through until March 1965. The dates are as follows: Nov. 15, Dec. 20, Jan. 17, Feb. to coincide with the National Field Day, and Mar. 21. Except for Feb., the times are 1100-1700 hrs. E.A.S.T. Feb. will be the same hours as the N.F.D.

The following rules will apply: One contact per band per day. No arranging of schedules or contacts from band to band. No crossband contacts. Independent of S.E.C. or private mains supply (portable motor generator/alternator sets allowed). The portable location must be more than 1 mile from the home QTH. Operation must be within the terms of the Amateur licence.

Scoring will consist of: Home to home, 1 point per mile; home to portable, 2 points per mile; portable to portable, 2 points per mile.

A special bonus of 3 points per mile for each mile from the home QTH, provided that 1 station is worked from the portable location. The bonus can only be claimed once per field day and can only be claimed for one location. That is, you go 90 miles to a portable location, then over and above the mileage score an extra 270 points can be claimed provided one contact is made.

A certificate will be awarded to the winner of each individual field day. If a person wins more than once, the certificate will be endorsed for each subsequent win.

Scores must be submitted to the Publicity Officer by the second Thursday following the field day for consideration. All that is necessary is the points score to reach 3ZCK by the time mentioned.

Well everybody, I would like to wish you all the Compliments of the coming Festive Season and a very prosperous New Year with plenty of DX. I will be around every day on 144.42, 144.5, 53.033, 53.4, and 53.73 between 20th Dec. and 30th Jan. Good luck and best wishes for the Ross Hull Contest. 73, 3ZCK.

QUEENSLAND

During October two notable events took place. Firstly, there was the annual Scout Jamboree-on-the-Air and, secondly, there was Brisbane's first "mobile night". V.h.f.-wise, the Jamboree was a tremendous success. There were quite a number of stations who did not have Scouts with them, but it was these stations that made the week-end the success that it deserved to be.

Bob 4ZRC had a hectic time at Mt. Cotton where at one stage he had 35 Scouts camped around him. There was so much radio activity down Sandgate way that the local Scout group held a barbecue without a fire! You have all heard of r.f. dielectric heating and Tom 4ZAL now knows the meaning of "ground loss factor". Royce 4ZRH and Roy 4ZRM both had Scouts in to see and work all the switches and dials. Ron 4ZRJ and David 4ZDF operated portable from Scout dens. Grahame 4ZGN provided a station at Scout Headquarters, but on Sunday 18th it was operated by Peter 4ZPG. Mick 4ZAA was operating very low in the band that week-end. However, his frequency was definitely above 3.5 Mc.

The first Brisbane mobile night was held on 14th Oct. Six mobiles took part. The start was at 7.30 p.m. at Riverview Tea, and the night finished at about 10.30. I don't know whether this night was unique, but the idea was that each mobile would take a turn at hiding. The others could then ask him questions, the answers to which could only be yes or no. By this means the hidden mobile could be found. This type of activity has three advantages. Everyone has a turn at hiding in the one night. No directional aerials or special receivers are needed as for tx hunts and finally the YLs can do the operating while the Amateur drives the car or . . . Malcolm 4ZEL, chief organiser for the night, burnt out his change-over relay but completed the evening with a piece of wire from the tx out the window. With more than 30 watts in one end of the said piece of wire, something was bound to come out the other end!

Here in brief is an account of what the boys have been up to in the last months. Des 4ZJR has been working too hard lately with very little time left to spend in the shack. Bill 4ZBD cannot get his v.f.o. to operate his tx. Likewise, Frank 4ZAS is having the same troubles. Henry 4HC is back on both 6 and 2 mx. Les 4EH usually is around at 4.30 p.m. on 6 mx looking for mobiles. Peter 4ZCS has been heard occasionally during his lunch-hour or should it be lunch-half-hour? Jim 4ZJF must be hanging fire every week-end now and it is time that Dane 4ZAX stuck the whip back on to the mobile.

Walter 4ZPW is thinking seriously of 6 mx after his exams. He has worked three stations in as many months on 2 mx and is getting tired of calling. Bert 4CP is pumping out the watts on 144 mega, using an 832B, and Phil 4ZEP has had to be a little careful on how hard he drives his final. David 4ZDF has suddenly put covers on his rig and Alan 4ZLM is at present making two beams from the three he has.

Victor 4ZBT is still way up the band where no one looks and Lawrence 4ZLL has been mobile around Mt. Cootha rather frequently. Bob 4ZRC has a converted channel zero beam for his mobile which is very handy. Roy 4ZRM is receiving signals through an S9 noise level and has been talking about video. Royce 4ZRH is usually around on Sunday mornings after the W.I.A. news, as is Tom 4ZAL. David 4ZEK will soon be sounding like a duck if the transistors work and John 4ZJB was back on the bands for the Scouts.

Jim 4ZRA is using a log periodic but is having trouble with noise. Brian 4VR and John 4ZWB are still having regular contacts every Sunday night at 1900 on 144 Mc. Bill 4WD has moved to a choice v.h.f. location in Ipswich and Wayne 4ZBN can expect some QRM in the near future. Dave 4ZJH using battery power from Lake Manchester, is puting fine signals into Brisbane. Noel 4ZNJ and Malcolm 4ZEL have been mobile quite often round the town. Angus 4ZIC was the answer man when the Ipswich Radio Club visited the Amberley R.A.A.F. base.

No sounds to report from Laurie 4ZBL or Ross 4ZRD. John 4ZAV has his antenna back where it should be and Ken 4ZKP has found out the advantages of a v.f.o. Bruce 4ZCM is going strong on 144 Mc., as is Mick 4ZAA. Grahame 4ZGN supplied the official station at Scout Headquarters for the Jamboree. George 4ZLG has refused to connect up the wires from his beam rotator as the exercise of running out of the shack and climbing the tower is good for him.

Vince 4VJ has been on 6 mx consistently and Paul 4UL has made his first transmission on 52 Mc. He was one of the 6 mx gang in days gone by. Laurie 4ZGL is busy looking after W.I.C.E.N. here in Queensland. Ron 4ZRJ has made a re-appearance on the bands and is thinking of converting his motor scooter mobile to transistor operation. Finally, I believe there is a 6 mx hook-up each Sunday morning prior to the W.I.A. news in the Bundaberg district.

Channel Zero has begun transmitter construction here in Brisbane. The site is about 300 yards from my QTH and as Dane 4ZAX says, although the upper sideband will be 50 db. down, I will still get about a megawatt of signal from the station!

The Christmas Season is just about with us, so I should like to take this opportunity on behalf of newshound Tom 4ZAL and myself to wish everyone the Compliments of the Season. 73, Peter 4ZPL.

(Continued on Page 38)

S W L

Sub-Editor: Chas. Abernethy, WIA-L3211
30 Urunga Parade, Miranda, N.S.W.

With yet another year drawing to a close, we find that during the past months, increased interest in our hobby was revived in all States. We lost a few contributors to our page, but we gained overall. It is surprising the number of non-members who read our page and by answering their mail in the normal way, we have gained a number of new members.

In all walks of life, nothing is gained unless one is prepared to work to achieve that which one seeks. QSLing is no exception, so if you want returns, spend time on your report, and make it of some value to the person concerned. When sending reports, you must include the call sign of the station heard, date, time G.M.T., frequency, QRN, QRM, QSB (if any), readability, signal strength, weather, mode of transmission, your type of receiver, antenna height and direction of same, plus portion of the QSO as confirmation. Reports to overseas Commonwealth countries enclose a Commonwealth reply coupon, to other countries an International reply coupon, whilst in Australia a stamped addressed envelope may assist in getting you a card in return. The above coupons are available at all post offices.

SENSITIVITY

The sensitivity of any receiver is the amount of r.f. input voltage needed to produce a specified amount of audio output power. It would seem that any amount of sensitivity could easily be obtained by adding more r.f amplifier stages. But this is not so, because of the presence of noise. Noise is any undesired electrical disturbance within the desired frequency band. Noise is already picked up by the antenna in the form of atmospheric disturbances, called static, and man-made electrical interference, produced by a variety of electrical devices. External and internal noises are amplified by all the stages of the receiver along with the desired signal and eventually tend to drown out and mask the signal.

It is evident, therefore, that the usable sensitivity of a receiver is not determined by the absolute value of the signal strength at the receiver input, nor by the number of stages of amplification, but rather by the ratio of the signal strength to all noise present at the input of the receiver. It is this signal to noise ratio at the input of the receiver, therefore, that limits its maximum usable sensitivity.

Little can be done to improve the signal to noise ratio for a given receiver circuit or system of modulation. There is, obviously, no point in amplifying the signal with the noise beyond the point where the noise itself becomes objectionable, since this will only make the signal, plus noise, louder but not more intelligible. However, since noise is more or less uniformly distributed over the entire frequency, the noise pick-up can be reduced by limiting the bandwidth and hence audio fidelity passed by the receiver. In communication type receivers, where audio quality is of secondary importance, the bandwidth is generally cut down to the bare minimum for acceptable intelligibility. It now becomes evident, why frequency modulation, which does not respond to amplitude noises, is such a boon compared with a.m. reception. The signal to noise ratio and, hence, usable sensitivity of f.m. receivers is far greater than that of a.m. receivers.

NEW SOUTH WALES

At a recent meeting of the VK2 S.w.l. Group application was made for membership by two young lads, who live at Wodonga, which is situated just over the border in VK3. These lads are members of the Albury Radio Club, where they claim to do their listening. The matter of acceptance was discussed at length by our committee, and finally we sought judgment from the VK2 Council, whose decision was that they must join the VK3 S.w.l. Group. Mention was made re the L2/VK4 numbers, and it was found that these were allocated some time ago as there was, and still is, no S.w.l. Group in VK4. We lost two members, but trust that L3 will gain, and so increase membership generally.

A welcome to our Group goes to John Laidlaw, L3013, and ex-L3, Mac Hilliard, who is now L3074.

Ray L3287, during October, logged on 14 Mc. some 50 countries, which is quite a good effort. Ray was using an AR7 rx. Mac L3074 has received QSLs from OK3AL, 3N2JKO, 3P3KCC, KP4CL, and UM8KAA. He reports good conditions to W land on 21 Mc. during October, with nil on 28 Mc.

Henry L3271 is busy trying to get going on the v.h.f. bands and tells of an S.w.l. Group in Ipswich in VK4. I would be interested to hear more about it OM if you can manage to get some details.

Bruce L3283, welcome to our page OM. Do not be disappointed re QSL cards as they can quite often be a long time in arriving.

VICTORIA

The VK3 S.w.l. Group conduct a radio construction night on the second Friday and a general meeting on the last Friday of each month. During the past few months the Group visited the VW factory and ABV2 television studios, both visits being of immense interest to all who were fortunate to be present.

There was some arm twisting at the Sept meeting, when the annual election took place and resulted in the following being elected: President, Harry Roach; Vice-Presidents, Geoff Perrin and Maurice Cox; Secretary, Ian Woodman, and broadcast correspondent, Brian Hannan. Members are reminded that the Group hopes to arrange a Christmas Party on 13th December, and to visit GTV9 studio in the near future, so attend meetings and listen to 3WI news broadcast for further details.—Ian L3006.

Eric L3042's rarer type QSLs received during October: AP2AR, MP4QFB, UD6BV, VR3E, VU2ANI, 5Z4AQ, UI8LB, UO6SD, 3W8, VQ8AM, LA2PH/MM, YO4WR/MM. After four years of "never give up trying," Eric managed to get his Andaman and Nicobar Islands QSL, VU2ANI. It came direct from one of the operators of the DX-pedition concerned. So never say die, keep pressing on ever hoping that one day the desired QSL will turn up.

Greg L3138. Congrats on getting the required for the Jo-Burg award, another one for the wall, hi. QSLs to hand during the month: XW8AU, JA3AHF, JA3AJF and W7OX, with one new country heard, UW9CC. All the best with your exams.

Noel L3161: I trust that you had an enjoyable holiday. Nice going with those four new countries heard, you are getting close to me on that ladder OM. I hope to meet you when I am in VK3 in January.

Peter Curran: I do hope that by now you have received your L3 number and that your busy period on the farm is over. Pleased that you liked Bob's article on transistors.

Drew Diamond: That is quite an impressive list of DX OM. By the description of your rx you are doing very well. I wish you success with your exams.

SOUTH AUSTRALIA

Alan L3068: That score of yours in the VK-ZL Contest was really a good effort and I feel sure that you may be at the top in L5. Congrats on getting the necessary for the Jo-Burg Award. Heard recently: KP3, HS1, PA0, AP4, HI8, CN8, and OH1. QSLs to hand: VR1B, JA3AFP, VE3ABP and ZL1ABZ. Good luck with your exams.

Tim L3067: Many thanks for the circuit of the crystal filter. We may use it at a later date. I trust that you are feeling better after your fall. You want to pick something softer than concrete next time. By the way, did you go round in better than 104? Stations heard: DU1, ZK1, OA4, FR7, VR1, KH6, YV4 and [illegible].

WESTERN AUSTRALIA

Peter L3021: Many thanks for your information re awards, but it shall be a little while yet before I shall be able to compile the article. What's this 1 a.m., and 2.30 a.m., till 6 a.m.? When do you sleep? Still, if you want results, you have to work for them, and you are sure getting just that! OK on your big score in the VK-ZL Contest. I do hope that it gives you another award. Quite a different tale in the VU2/4S7, still who knows? Latest cards to hand: ZD3, VP7, KM6, HA6, OK, UA.

Bryan L3038: Welcome to our page, Bryan. It is pleasing to know that another L6 has joined us and we trust that you shall continue to put pen to paper each month. Bryan uses a Murphy 160 rx with a long wire antenna, and his recent loggings are: FR7, KR6, HK4, OA4, YV4, DU6, FB8, 4S7, 9M4, ZS1.

Could anyone tell me the whereabouts of a chap who uses the number VK3 10181 as I have quite a few cards for him?

Thanks to all those members for writing during the year, your assistance has been most helpful in keeping our page intact.

Wishing all Shortwave Listeners and Amateurs all the best for Xmas and the New Year, and hope those long awaited QSL cards come alive in '65. 73, Chas L3211.

S.W.L. DX LADDER

	Countries Conf.	Countries Hrd.	Zones Conf.	W States
E. Trebilcock	295	293	40	30
P. Drew	141	243	34	30
D. Grantley	134	221	35	25
A. Westcott	97	150	31	11
M. Hilliard	81	241	25	14
M. Cox	84	232	30	21
G. Earl	70	181	22	10
C. Abernethy	64	106	23	14
N. Harrison	56	176	21	27
L. James	51	144	24	10
I. Thomas	42	139	20	14
A. Raftery	25	121	15	6
R. Beckley	27	80	19	—
R. Oats	9	26	3	—

☆

VHF NOTES

(Continued from Page 25)

WESTERN AUSTRALIA

The last fox must have been having cubs, because it was on the limit of the metropolitan road maps. A 9-watt signal into a 5 over 5, 30 ft. high on a small hill, it put in a 6 and 9 signal 30 miles away at the starting point. There might as well have been a river in the way for there was no easy way to it and only two hounds found it—6LR and 6ZDB. Wanted: Ham not participating to relay bearings to hounds in trouble.

At the last meeting on 26th Oct., main business was the Xmas Party and the type of liquid refreshment. The wowsers were finally subdued, although their argument that doping of the hounds would be hard on the fox had some merit. 6LR is going to be busy as he is organising the Xmas Party and the National Field Day. It will give him something better to do than rewinding genemotors to work as alternators.

The f.m. mobile sets are a delight to use. I sometimes wonder how many taxi drivers went mad listening to noisy old a.m. For those country members interested, some a.m. sets using 6J6 in the final are available. Please write to Mr. H. Pride, 36 Lockhart St., Como, who is conducting the ballot. Price should be around £5/10/0. Rumour has it that some 15-watt f.m. sets will be available soon, but nothing definite. The a.m. sets available need some conversion work done on them like crystals and variable tuning. 73, 6ZAG.

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Publications Committee Reports That . . .

All mail received at P.O. Box 36 up to the evening of 9th November has been printed in this issue of "A.R.," with the exception of technical articles contributed by VKs 3RM, 4SS, 2AKB, 3SK, W1DFS and R. W. Humphreys.

The question of the colour for the front cover of the 1965 issues of "A.R." was resolved and a "grecian blue" was chosen.

The result of a meeting with F.E. regarding the "Call Book" was reported upon and the delays in publication were explained. It is anticipated that the new issue will be available mid December, but it may be delayed in posting by the Christmas peak mailing period, hence all readers should not be disappointed if it is not available in their State until mid January, as it has to go second class mail.

The increase in cost for "A.R." having been ratified by the Divisions, will enable your Committee to add new features as from 1st March, 1965. Fuller details will be announced in the next issue.

With the close of this year it is fitting that your Committee thanks you for the manner in which you have assisted in maintaining your magazine. It is difficult for all to help, but we are truly grateful for the manner in which all contributors have been able to maintain continuity of notes and reports, etc. It is our sincere wish that with the coming Christmas period, you and yours enjoy all that is good.

Notes for the January 1965 edition of "A.R." closed on 1st December, and it should be remembered that due to Christmas shut-down at our printers, that the February 1965 issue of "A.R." will not contain any notes or reports. The February issue will contain only technical articles. Standard layout will resume with the March issue of "A.R."

FEDERAL AND DIVISIONAL MONTHLY NEWS REPORTS

(SEND CORRESPONDENCE DIRECT TO DIVISIONAL REPORTER NAMED AT PARA. END)

FEDERAL

I.T.U. FUND

As agreed at the last two Federal Conventions, Divisions were given target figures to meet towards financing representation at forthcoming I.T.U Conferences. To date, the percentage of the target figures met are shown by States —

VK1	—
VK3	35%
VK4	47%
VK5	33%
VK6	75%
VK7	50%

The above figures represent monies received by Federal Executive and not necessarily monies still held by Divisions.

AFRICAN I.T.U CONFERENCE

In the middle of October a special conference, convened by the I.T.U. aimed at drawing up a medium broadcast plan for Africa, attempted to exclude Portugal and South Africa from the proceedings. Both these countries claimed the decision was illegal and refused to leave the hall following a vote to exclude them. Other African and Arab delegates walked out of the Conference. Western countries endorsing South Africa's and Portugal's stand were Britain, France, Belgium, Luxembourg, Italy and the Netherlands. The I.T.U. Secretariat also supported the example of the West and without the agenda being discussed, the Conference ended a week earlier than expected.

ILLNESS OF FEDERAL SECRETARY

Mr. Jay Lancaster, VK3JL, the Federal Secretary, has had a serious bout of pneumonia and has spent the last few weeks in bed. As a result, some outstanding correspondence has not been answered. These matters are being dealt with now, so please bear with us a little longer if you are awaiting an answer to your letter. The illness of the Secretary is the culmination of a series of minor troubles and it is likely that following medical advice that he will need to take things a lot easier in the future. We all wish Jay a speedier recovery and return to good health once more.

NEW MEMBERSHIP CERTIFICATES

A new membership certificate has been prepared and already small quantities have been issued to some Divisions. As soon as possible, quantities will be forwarded progressively to all Divisions, as the signing and sealing is no small task.

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FEDERAL QSL BUREAU

Bruno Bossert HB9QO, who has been working in VK2 and VK3 during 1964, returned to Europe by sea in November. Bruno was engaged in the installation of remote control power switching equipment associated with Snowy River Hydro-Electric scheme. He will arrive in HB just in time to assist his family to move from Nottwil to Brunnen. Bruno visited VK2, 3, 4, 5 and 7 during his stay in Australia.

Len Smith, VK4TE, currently on Willis Island, is active on 14100 kc. c.w. and s.s.b., mainly at week-ends. He is not presently interested in QSLs, but may reconsider when he returns to his home QTH in June 1965.

The Long Island (U.S.A.) DX Association is sponsoring an annual marathon DX Contest. Details of this marathon contest appeared in November "A.R." (page 6) and further information may be had from this Bureau.

Details of the following newly announced Manager, Colombia 6N1 Award, Angola Z38A awards may be had from the Federal QSL Award, Spain Annee Sainte de Compostelle Award, Australia Down Under Award. Writer also has a current issue of the C.H.C. Directory of Certificates and will be pleased to supply any award info for s.a.s.e.

Ken Matchett, VK3TL, has completed all arrangements for his one-man DX-pedition to Norfolk Island. The operation will cover the whole of January 1965 and Ken has been issued with the call sign VK3TL. Ken will use s.s.b. and c.w. on 7, 14 and 21 Mc. bands. All QSLs should be sent to VK3TL either direct or via Federal Bureau. Ken's home QTH is Smiths Road, Templestowe, Vic., and he stresses that on NO account should cards be sent to Norfolk Island.

Writer wishes all readers and Divisional Bureau Managers the best wishes for Xmas and 1965 and the hope that the forthcoming year will produce higher QSL totals, after a very lean 1964.

—Ray Jones, VK3RJ, Manager.

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NEW SOUTH WALES

HUNTER BRANCH

The November meeting of the Hunter Branch was held at the Tech. College, Tighes Hill, on Friday, 6th November. The guest lecturer for the evening was Col. H. J. Trick, of the Military Products Division of A.W.A., who spoke on Microminiaturisation and Military Equipment. The best attendance for some time, 50 members, associates and visitors were present to hear a most informative lecture, delivered in a professional manner. One of the rather startling facts which Col. Trick told the gathering was that a certain new bomber uses one million transistors in the guidance and electronics system. I am wondering what Bill 2ZL would have to say about a service job on one of these. Many of the boys are having second thoughts about the abilities of computers after listening to some of the rather strange stories told by the Colonel. The other colonel, Cox, Frank 2APO, moved a vote of thanks to the lecturer and this was carried by acclamation. Whatever you do, don't fail to be at the next meeting to be held on 4th December—but more of this later.

Since the field day several members have had quite a deal of publicity in the local scandal sheets. One such was President Frank who had a poem written about him having a certain small out-house on the front lawn outside his Merewether home. Being clean-up day, the City Council had threatened to take it away and Frank had to commission some unsuspecting lady friend to write an ode to the dustman. It was all very humourous and the publicity was even funnier when we knew it was Frank.

Mac 2ZMO is having much the same sort of strife in an attempted duplication of facilities at his shack. I am told from a most reliable source that he spent several hours the other day taking a bearing on an interloper in the two metre band only to find that it was generated within his own rig. Since then the red face department has another supporter.

Up in the coal city of Cessnock, now known as the r.f. centre, Sherwood, of sidecutters fame, is known to be contemplating taking unto himself a reliable cook since he found the water inflammable when boiled at the old residence. It is even said that he is on the air, but I believe this to be just another nasty rumour.

The 160 metre adherents are having a field day and I know of four top-band transmitters just waiting for the power to be switched on to be active. One of these fortunate people is none other than Stan the QSL man, or 2AYF to you others. Jan 2BJO, having had some practice at sending dah di di di dah for several hours, has now graduated to a bug, so goodness knows what will happen. His top band transmitter is going like a charm and according to his off-beat calculations the efficiency is 125 per cent! There's one for Mr. Euclid. Lionel 2CS has returned from his jaunt down the South West reporting to all that he heard the Monday night broadcast on a transistor portable. Perhaps it was one of the good ones. Gordon 2ZSG now has the staircase in the new shack and has thrown away the jacobs ladder and taken his wife off full time duty on the winch.

It's really much easier now. Bill 2CW is reported to be making a comeback and may soon be heard on 80. Warren, his son, seems to be the driving force and Bill finds it easier to get the rig going than make excuses. The boys from the Westlakes Radio Club had a most informative night out last month when 13 of them visited the transmitting station of the National Broadcasting Service and saw ZNC/2NA on the air. Mad Mick of course just happened to be in the transmitter cabinet of the spare unit when someone put the blower fan on and almost caused him to turn grey within seconds. Over keen we call him—to his face.

OBITUARY

JIM CORBIN, M.B.E. (VK2YC)

The N.S.W. Division and the W.I.A. suffered a severe loss with the death on 29th August of James B. Corbin, M.B.E. (VK2YC).

The name of Jim Corbin and the call sign VK2YC were prominent in the life of the W.I.A. and on the Amateur bands for more than 30 years.

As a member of the W.I.A., Jim was an Associate on joining in 1928, a Full Member on obtaining his Amateur Experimental Licence in 1933, and an Honorary Life Member in 1951.

Throughout the DX world, VK2YC was well known, especially when the 28 Mc. band was open. The 28 Mc. band was Jim's favoured DX band and many DX operators shared his reminiscences of the ten metre DX of pre-war years.

From 1933 until 1937, Jim was QSL Officer for the N.S.W Division and in this capacity was also well known wherever QSL cards circulated.

First elected to the N.S.W. Divisional Council in 1937, Jim served the Division again in 1947-48, from 1950 to 1953, from 1953 to 1958 and again, despite ill-health, in 1964. During these periods he was Divisional President in 1950/51 and from 1953 to 1958.

In 1938 Jim was appointed N.S.W. representative of the R.S.G.B. and the R.E.R.U. During several terms as N.S.W. Federal Councillor, he represented the Division at Federal Conventions and in 1963 and 1964 was Official Observer in Sydney and Adelaide.

Members will remember the feature "Blouch Hats and Forage Caps," dealing with the activities of Amateurs in the Armed Forces, which Jim wrote for "Amateur Radio" during World War II.

Jim's pharmacy at Eastlakes became the control station as VK2WI/VK2YC for the Divisional Emergency Network on a number of occasions between 1954 and 1956 and for his work during the disastrous floods in Feb./Mar. 1955, Jim was honoured by the award of the M.B.E. This award he always insisted was "The Institute's M.B.E."

Feeling the need for an official emergency station, Jim aroused the enthusiasm of his Division to buy land and erect a fine building at Dural, about 24 miles from Sydney, as a "Home for VK2WI" and as a memorial to his fellow Amateurs who had served the community during emergencies. It is from here that the N.S.W. Divisional broadcast takes place.

Jim's work for the Institute was untiring. During his terms as President, he devoted himself selflessly to Institute affairs, visited country centres to make contact with local Amateurs, urging them to W.I.A. membership, and attended Conventions throughout N.S.W. and in adjoining States. Visitors were always welcome to his home and his hospitality was extended to all. Never strong physically in recent years, he was to be seen almost every week-end working in the grounds and garden of the Divisional station.

The N.S.W. Division owes a debt of gratitude to Jim's widow, Ruth, his four sons and daughter for their service to the W.I.A. over many years. To them we express our sincere thanks and our deepest sympathy.

More than twenty-five Amateurs attended the funeral on 2nd September and as a final tribute to their former colleague, the casket was carried to the graveside by four Past-Presidents of the N.S.W. Division—VK2EO, VK2HZ, VK2VN and VK2YB.

Belmont Bob is doing the right thing and has a morse class going at his place of residence. The boys are making good progress and can copy Bob's sending—which is more than some of us used to be able to do. Do you remember Sig. Blyth? I do. Max has been burning some midnight fuel at the clubrooms and now has the complete morse set-up in for the A.O.C.P. class. This has ten positions and enables the operator to talk to any of the students individually or collectively and for them to practice in any group size they wish. This means that the club boys are going on space with the morse and some are to try for the January exam.

Len 2ZFD reported the other night that he is almost ready to roll on 432 Mc. and Des 2ZDN is still having the same success with the miniature 2 and 6 metre rigs. So much so that he almost blew Mr ZKW's speaker out the other day when passing by on a service call. Up in the blue grass country, round Singleton, the grass has been scorched by the latest U.S.S.R. satellite putting out positively blistering signals into Geoff's receiver. Geoff said it was the loudest and broadest v.h.f. signal he's heard. Which reminds me, we haven't heard from the Oriental Jaunter for a month or three and it has come to my ears that the lecture for the December meeting is to be given by Australia's most disappointed athlete. He didn't get a gold medal. But he did make some pretty pictures, so what about coming along to see them. The meeting place has changed for just this once and will be in the dining room of the Prince of Wales Hotel, Merewether. Bring some few shillings with you, as we're having a buffet type supper. It starts at 8 p.m. on 4th December. If I don't see you, have a Happy Christmas and I'll see you when you're older. 73, 2AKX.

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QUEENSLAND

NOTES FROM DIVISIONAL COUNCIL

The October Council meeting was held at the Rooms of the Social Services Institute at Berwick St., Fortitude Valley at 8 p.m. on Thursday, 1st October. Nine members of Council were present. In the absence of Peter 4PJ, Vice-President Lional 4NS took the chair. The minutes for the previous meeting were read and adopted. Instructions were issued to proceed with the purchase of a crystal to allow 4WI to operate on 6 metres. This crystal should soon be to hand. Such a statement was made back in July, but it is hoped that the crystal will appear this time.

A quarterly report on Youth Radio activities in the State was tabled by Charlie 4UC. Paul (disposals officer) reports the coming to hand of a fair quantity of gear, so watch "QTC" for the bargains. Taxi transceivers were still in short supply at the beginning of November, but orders will be taken and filled as soon as possible.

OCTOBER GENERAL MEETING

The monthly meeting was held on Friday 23rd at 8 p.m. It was well attended and an estimate of the number present was given as 60 members. After the minutes of the previous meeting were read, the names of new members for the month were presented to the meeting and accepted.

Claude 4UX took the floor and talked on "Broadcasting Stations and Their Equipment". The lecture was spiced with humourous descriptions of some of the memorable experiences he has had while working on National broadcast transmitters. Later a short discussion on "Seacom" as applied to the microwave link between Brisbane and Townsville, was held. Visitors to the meeting included Eric Nissen from Dalby (4QS) and Ed Pendleton (ex-WA6).

GENERAL NEWS

News of the month was the Picnic held at Victoria Point to honour two members of the Kingfisher group. George 4GG and Bill 4WS were the guests. The Kingfisher group were all complete with XYLs and harmonics. During a speech in reply, it was noticed that George did not include even one growl! It was very interesting to be amongst these Amateurs whose participation in Amateur Radio dates back many years. Newt 4QW made reference to the year 1902! George had with him a syllabus of exam. questions from the early days. How would you go if you were asked how many volts are necessary to make a spark jump ¼" across two needles? Further, next time you see Newt ask him about the regulations that applied in the early days.

Recently I spoke to two members of the Padua Youth Radio Club operating under the call sign 4PE. They told me quite confidently about their equipment, a Geloso v.f.o., reference shift modulator, 6146 final, 40 metre folded dipole and AR7 receiver. The boys were on 6 metres from the shack of Les 4EH. They had one comment which may be food for thought. Although they have had over fifty contacts so far, they have only received back ten QSL cards! I leave it in your hands.

On behalf of the VK4 Council, I wish all readers of this column all the best for a very happy Christmas and a prosperous New Year. 73, Bill 4ZBD.

TOWNSVILLE AND DISTRICT

Very sorry that I missed last month's notes, due to the fact that I was not feeling the best owing to my old complaint "bad back". Needless to say, this has left me, hence the few lines this time.

Owing to the fact that I am not hearing much on the bands, must be that I am losing my touch in not being able to pick the right times to listen. Witness the fact that Bert 4LB is working the Europeans around midnight, yet when I listen at this time on my suitable shift, it all seems dead or that the few are hardly audible. The other night was able to work Jim GI3JIM after many years since last QSO.

Charlie 4BQ has the 40 metre Quad going and certainly shows up on the skyline. Seems to be an added attraction to Townsville Centenary Year. Vern 4LK being honoured with a Dinner in appreciation of his long time with the Flying Doctor's Service. Certainly nothing is a trouble to him to help out in the time of need.

Not having met the boys in Townsville of late, am unable to give any news on what is happening. What with no local club, seems that all and sundry have tended to watch the one-eyed monster. Maybe when the sunspots get like the measles and DX returns once again, there will be a renewed outburst of energy to get things as they were in the days gone by.

As I will be in Melbourne on annual leave as these are being read and will miss out on the New Year notes, unless Bert 4LB fills in meantime, I wish each and everyone the Season's Greetings, with a fervent wish that the coming year will be on the up and up. 73, Bob 4RW.

SOUTH AUSTRALIA

The monthly general meeting for October of the VK5 Division was held as usual in the club rooms to a capacity gathering of members and visitors, and took the form of a jumble sale, ably conducted by that ace of auctioneers, Brian 5CA, assisted in no small manner by our worthy President and champion of s.s.b., Phil 5NN. Everything worth writing about these types of night have been written many times in the past and much as I regret not being able to pad a little at the expense of the night, I decline to do so. After all, I do have a conscience. True as true! Suffice to say, everybody present thoroughly enjoyed themselves, and a good time was had by all. No business was conducted, general or Federal, although the President did announce, with a warning glare in my direction, that if anybody did have any urgent business to discuss, now was the time to go ahead. Honestly, I was not game to stand up, I was quite bulled —I mean cowed.

It was announced at the meeting that the Federal Secretary, Jay 3JL, was still somewhat indisposed and all present expressed the hope that he would soon be restored to health. Hope by the time that you read this OM that you are in the pink again.

Leith 5LG is among the missing. Not at the meeting, not heard on 3.5 Mc., in fact a conspiracy of silence. Where are you OM? Don't tell me that I have scared you off. Also, where is the ex-Mayor of Lucindale? Can it be that the Semaphore shrimps have him in their clutches or is it that the Largs Bay cockles have him in hand? Can it be that the Outer Harbour oysters occupy his attention. Anyway, where are you Arch 5XK?

Gilbert 5GX strutting around the meeting with his chest out like a pouter pigeon. The reason? Well, it took a lot of getting out of him—he is modest like me—but he had worked a South American that afternoon on 7 Mc.—a somewhat unusual effort for VK5 if I might say so. What was the report from Peru, Gilbert?

Talking of unusual DX, I asked Ses 5GP if he was working anything much, and he said in a very condescending manner, "Only the usual Cubans, South Americans, Mexicans and Russians." How would they be? Only the usual—wouldn't it!

Talking to Arthur 5HY, after he had finished trying to indoctrinate me again in the merits of s.s.b., I noticed a listener's report card from France addressed to him, stated that the listener was using a Maria Maloca aerial. For goodness sake, what next will they use for aerials? It's that s.s.b., that's what it is.

Compa 5EF was at the meeting and remained tight lipped in my presence, evidently determined to give nothing away. I complained to Les 5AX about this, and he bounced back at me, quick as a flash, and said, "You couldn't understand him if he did talk." Well, how is that, these Gawler boys must have had vinegar on a fork before they left for the big smoke!

A welcome visitor at the meeting was Arthur ZL3RE, over here on a short visit. It appears he met Les 5LC who told him about the meeting night. Nice to meet you OM. Also nice to know that you are on s.s.b. Down with s.s.b.!

Heard the two Jacks—5JS and 5LN—in QSO on 7 Mc. the other Sunday afternoon, and the comments from Jack 5JS on current happenings in the radio world made merry listening. Apparently he had been bargain hunting again, and was well pleased with his purchases.

Stuck around on the frequency at the end of the QSO and was well rewarded by hearing Athol 5LQ come up and call Jack 5LN and take him to task for not being on at aked time the previous day. Have been trying to locate these two for months, but they have been very elusive and decidedly canny in their remarks. A nice pair, these two, and definitely a handful for their respective XYLs. Distinctly heard Athol say, "You tell her that I kept you late, and I will say that you kept me late." How low can one get?

Also heard Howard 5XA and the Admiral 5VB in contact on 7 Mc the next evening, and although they would only be a stone's throw from me as the crow flies, their signals were swinging about all over the place. Nice signal Vern, also nice to hear you once again Howard.

I never thought that I would live to see or hear the day that Carl 5SS would be on the air on 7 Mc. without being hooked up with Frank 5MZ. However, the impossible happened the other Monday evening when I listened to Carl and a couple of VK3s discussing high quality recordings. Waited patiently for the voice of Frank to come up, but nothing doing. I will have to look into this phenomenon.

Col 5HY must have some interested parties up Balaklava way as I am led to believe he was asking on 3.5 Mc. for some application for membership forms to be despatched to him. Good work, Col.

Bob 5RI, not heard here for quite a while, was also heard on 3.5 Mc. with his new Viking, and gave the information that he had been playing around with opening his gate, using a model aircraft type of transmitter, plus motors of course. Was intrigued to hear him say that the radiator grille of his Falcon resonated nicely at the frequency and made a nice aerial for the job. Unfortunately, the mixmaster in the kitchen managed to get into the act at times and opened the gate at the slightest provocation. Like Pete 5FM, he has also acquired a boat and is scaring all the fish in the locality.

Dud 2DQ apparently takes it for granted that every time he comes on the air that I am sure to be listening in. He never fails to include me in the QSO, disparaging remarks free for the asking, although why he should think that I would bother to listen to his duck talk beats me. Hope your bi-focals don't focus OM!

Ron 3OM advises via the grapevine that the VK3 Division have the same set-up in Morse tapes as the VK2 boys, but not for loan, only for copy. Send your tape along to him, ask nicely, and he will be pleased to dub your requirements. Apparently the VK3 notes are perused by more people than I thought.

I managed to find out the reason for not hearing Frank 5MZ lately. It appears that he was at a birthday party for Carl 5SS recently and at supper time Frank, like Oliver Twist, had the cheek to ask for a spoon to stir the coffee. When Carl's XYL (Jean) went to the drawer to get him a spoon, she was overcome to find that all the silverware had vanished. To draw a veil over the shocking scene, the silverware was found bulging from Frank's pockets and although rumour has it that he only got six months, I believe the judge said only his youth saved him. Naughty-naughty-Frank.

OBITUARY

NORMAN COLTMAN

The VK5 Division announces with sincere regret the sudden passing of Associate Member, Norman Coltman, on 18th October, 1964. For many years Norm was Associate Members' Representative on the VK5 Council and an active worker for the Division. He will be missed by all with whom he came in contact.

To his sorrowing widow (Gwen) and his two sons we extend our heartfelt sympathy in their sudden and sad loss.

I told John 5KX at the meeting that I was short of news for this month and could I send him away for his world tour earlier than next June. He said it was OK by him, but not to bring him back any earlier. Now what does that mean?

I notice that in the Electricity Trust of S.A's house magazine that there is a list of all the licensed Amateurs working for E.T.S.A., which leads me to ask does the W.I.A. support E.T.S.A., or does E.T.S.A. support the W.I.A.? Incidentally, five out of the nine Council members are with E.T.S.A.

Geoff 5ZCQ, our worthy Federal Councillor, is the scribe for the above-mentioned magazine, and if reports of his efforts are to be believed, the VK5 Division have a ready-made sub-editor for "A.R." magazine in their midst should I ever decide to throw in the towel. He tells me that his XYL now has her driving licence and warned me to keep off the roads. I would much rather resign from the job than be carried out OM!

As mentioned last month, the family castle has been in the process of being brought up to 17th century living conditions, and one of the carpenters on the job soon located my shack and was suitably impressed with the contents. It did not take long to wake up that he was another of that army of frustrated would-be Radio Amateurs who would have liked to be but never quite found the time or the opportunity. He had originally come from Poland, had a name that was a cross between a sneeze and a hiccup, and when he discovered a QSL card on my wall from his home country, in fact in the same street as he was born, we were buddies for life. I could not hope to pronounce his first name, so I settled for Bill, and naturally Bill twisted my arm enough to give him a running description of my shack and its contents. Now although I say it myself, my shack is well worth showing off, in fact the late Doc 5MD always said that it was the most technical looking shack in VK5, and the least used, but then he was always flattering me. To make a short story longer, what I am getting at is that I was quite prepared for Bill to go into raptures over my shack and the equipment on display, but our beautiful friendship came to a fast and short stop when the first thing Bill said as we entered the door of the shack was, and I quote, more in sorrow than anger, "Did it take you long to build up your s.s.b. equipment?"!!! I learned later on from one of the painters, who fortunately had no interest in Radio—Amateur or Commercial—that the aforementioned Bill had a diploma in electronics from some university or other in Poland. S.s.b. indeed, we now curtly greet each other should I not see him first!

The news of the passing of Associate Member Norm Coltman came as something of a

shock to me and many others, especially as I had only alluded in the notes last month that I had met him and that he seemed definitely on the way up from his recent glandular trouble. Norm, for many years, was a keen and active worker for the Division, in fact he was the members' representative on Council for quite a time, was always well to the fore at the annual picnics, and could always be counted on for any active assistance in any Divisional chore. Keenly interested in 288 Mc., he spent most of his time on that band, but in recent months had somewhat deserted Amateur Radio for the Masonic Order I came in contact with him, both professionally and as an Amateur, and he will be missed by many. So Mote It Be.

I notice that Bob 4RW, in his recent notes, inferred that I was not finding the going tough for news these days, and whether he pointed the bent banana at me or not as he said it, I will never know, but this month has been the worst month for news in VK5 that I have ever known in my long and unethical career as a newsgatherer I threatened to make up my own news, libel suits or no libel suits. I warned that my supply of noughts would cease if my espionage section did not hoist up their socks. I even tried to squeeze some news from our worthy President, Phil 5NN, but all to no avail, and as a last resort I threatened to resign the job as sub-editor unless all the clams opened up The cheers and sounds of rejoicing that greeted this threat quickly made me change my mind about this, and was probably the one spur that I needed to carry on. However, I must confess that my sense of imagination has been decidedly strained this month, in fact I am leaning a little way towards the theory often expressed by Ye Ed, that I have a slight tendency to pad these notes. Heaven forbid!

I have heard several chaps on the air asking where Roy 5AC is these days. Personally I have had no news of him for a long time, and knowing that he sometimes is guilty of perusing these notes, I suggest that he come out from under and give me something to write about. What about it Roy?

Understand that W.I.C.E.N had an exercise one recent Sunday up in the mountains, v.h.f. and the square band together, and a mighty successful exercise it turned out to be My informant, a definite s.s.b. addict, went out of his way to tell me that the 80 mx s.s.b. outfit excelled itself, and left me speechless, with his chest blown up like a pouter pigeon. What makes them think that I am so interested in s.s.b.? I hope all their fowls lay square eggs!

Right in the middle of the re-building operations at my castle, my XYL went down with pleurisy and pneumonia and the doctor was hurriedly called. Injections followed as a natural course, and my XYL, with tears in her eyes, is telling all and sundry that as she lay at death's door—her words, not mine or the doctor's—that her so-and-so Radio Amateur husband was more concerned in scrounging the plastic syringes from the doctor for coil formers, etc., etc., than he was in her rapidly deteriorating condition. To make matters worse, she also accused him of making coarse remarks and jokes as to where the needles were jabbed! Nobody understands me—yeah —yeah.

Received a letter from a VK4 S.w.l. this week, none other than L4024, and included was a very fine QSL card printed by the Ipswich City Council for the local radio club. Although a little off-standard for QSLs in physical size, the card is a splendid job and I feel sure that all who are lucky enough to receive one would be more than pleased, to say nothing of being interested with the view on the card of Ipswich and the relevant details of the city L4024, or to give him his real name, Ben Hall, came in to see me at 5DN when he was over here visiting our salubrious city (VK4 please note!) and we had quite a session one night in the control room, and he turned out to be quite a guy Nice to hear from you Ben, will be writing you soon. By the way, I am not that sweet with the Ye Ed. as you suggest—it is just that he recognises talent when he sees it!! More noughts on the horizon—maybe!

Our most gracious and noble President, Phil 5NN brought me in a bundle of Divisional bulletins this week with the suggestion that I might be able to use them to make up for the scarcity of news this month. I was overcome at this display of generosity and perused them with great interest. The VK6 bulletin impressed me most of all, probably my financial outlook and upbringing was the most impressed, on account of the discreet use of advertising on the front and back covers. This display of business acumen is one that could be copied with success by other Divisions and is to be well recommended. I managed to secure several paragraphs for the W.I.A. column in the local paper, the "Advertiser", and if this should, by some strange freak of circumstance meet the eye of any of those concerned with the various Divisional bulletins, I could use anything of news value from the other Divisions in the abovementioned column. If an odd copy or so should mysteriously find its way into my letterbox hot off the press, I will be more than pleased to give it the necessary publicity. How's that for diplomacy?

Wyck 5WM is deserting commercial radio for the field of t.v with the local A.B.C Makes me feel old—I remember when he started at the B.B.S.S. (for the benefit of any new readers, this means the Best Broadcasting Station in the State—if not in VK) as an office boy. Time certainly flies.

John 5JC phoned me this week with the news that the VK5 W.I.C.E.N had been invited to join in a simulated emergency exercise with the Emergency Fire Services and the St. John Ambulance Brigade, to be held on 8th November, at the Mount Barker Oval. This is good news and quite a shot in the arm for W.I.C.E.N in this State. Although from the details supplied, I am quite amazed at the number of cups of tea included in the afternoon's list of jobs and can only assume that the VK5 W.I.C.E.N members will be on standby for the local fire brigade!

Well, padding or no padding, I have made it again, and my quota of pages for the month is complete. Had you worried, did I not, my palsy-walsy Ye Ed? Never fear, Pansy is near, keep that red pencil clear. Anyway, seeing that these notes will appear in the December issue, may I on behalf of the VK5 Division, its Council and members, wish you all the Season's Greetings and hope that 1965 will come up with all that you want it to. Speaking personally, I am finding it extremely hard to get my usual Xmas cards with the Pansy motif, but do not despair, Pansy will get there. I hope! 73, de 5PS—PanSy to you.

EXTRACTS FROM ELIZABETH AMATEUR RADIO CLUB PRESIDENT'S REPORT

The past year has once again been marked by increased membership and activities within the Elizabeth Amateur Radio Club. The total membership at the present time stands at 38 members. It has also been quite pleasing to note the marked increase in attendance at club meetings

The administration has also seen a few changes, notably the Presidency and Treasury. Due to pressure of professional business, Tubby 5NO had to relinquish his position as President, and I was elected to complete his term of office. John 5QL, due to an occupational advance which resulted in his QTH becoming VK1, resigned as Treasurer and Bill 5WV was co-opted to complete John's term of office. Our thanks and appreciation are extended to Tubby and John for their efforts during their respective terms of office.

Once again the club decided against participating in the Elizabeth Birthday Celebrations, due to the commercial nature in which these proceedings are now conducted.

Next to the Christmas Social, the National Field Day Contest provides the most interest in club activities. This year, with the bitter taste of defeat still on our lips, the club was determined to restore our "lost" prestige, by outscoring "the mob from the east". In order to achieve this a new site, situated on Mr John Barritt's property at Gawler, Town Hill, was used.

The most successful venture carried out within the club to date has been the publishing of "Info," the club magazine, which to date has seen 14 issues roll off the presses. This success is due mainly to the three co-editors Ron 5FY, Angus 5DE and Tubby 5NO. The quality of the technical articles and features has been of the highest order; a standard which must be maintained if the success which "Info" enjoys is to continue.

During the past year the "Elizabethan Award" has again been much in demand, with 20 certificates being issued.

—C. J Hurst.

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TASMANIA

Here it is holiday and festive month again. My but it comes round faster every year. Our worthy President, Tom 7AL, has got in early this time (he usually doesn't get a holiday at all), but at time of writing he is enjoying the sun and sights on VK4s Gold Coast; taken the family with him, so don't know how many shacks he'll be able to visit but I expect he will have a few eyeball QSOs.

The November general meeting was very well attended with thirty odd members present and Vice-President Ian 7ZZ in the chair. Following the business of the evening, an auction was held consisting of odd items held by the Division and various pieces brought along by members; almost all was disposed of at the usual rediculous prices, the whole affair being carried out most ably and with the usual repartee by Brian 7ZBE.

One of our visitors at the meeting was Arthur ZL3RE, from Christchurch, who was holidaying in VK7. He brought greetings from Christchurch to VK7 Amateurs, and Ian 7ZZ reciprocated on behalf of us all.

Our Hamfest will be over by the time this is received by members, and the post-mortem will have been held. Let's hope the results are not too bad. If you attended, then you've helped make it a success, and your criticism, either constructive or destructive, will help to make next year's effort even better

The v.h.f season is upon us once again and the Ross Hull Memorial Contest of course is THE contest starting this month, the 12th to be exact. I hope all VK7 v.h.f. men who can spare the time will compete this year and submit a log. Let's make it interesting and give the other Divisions a bit of a run. I'll admit, the likelihood of a VK7 member winning the trophy is remote, but we can show them we do operate on the v.h.f bands, if we go about it the right way and see the contest through to its conclusion.

The Jamboree-on-the-Air this year was held here in variable conditions (both air and weather wise). All told, 32 Scout Groups were catered for by 20 Amateur Stations, all the VK and ZL divisions being worked. Let's hope for more stations and better band conditions next year.

Alan 7MY, who has been busy concreting and boat building for some months now, and consequently hasn't been heard on the air very much, has been in VK3 for a couple of weeks, visiting one of his daughters and the grand children. Hope you found them all OK Alan

Our December v.h.f meeting this year falls on Dec. 16. Keep it clear chaps, it will be once again a social meeting in the form of a barbecue at yours truly's QTH. Bring your own meat, etc Glasses will be provided. Any visitors, either intrastate or interstate, are welcome.

In closing, I must not forget to say that the President and Council extend to all members and readers the best Xmas and New Year Greetings from VK7 Division. "Far may your sigs radiate." 73, Geoff 7ZAB.

NORTH-WEST ZONE

There was almost a record attendance at our meeting on 6th October. Twenty-one members were present including newcomer Ivan Ling. Welcome Ivan, hope you enjoy yourself

Had another letter from Basil 7BL, who now has a new call sign, VE3APO, but has yet to hear a VK signal from his new QTH at Spirit River. Keep listening Basil, we'll see what can be done.

Believe George 7XL is in hospital. Someone suggested George is having his voice raised so he can modulate his s.s.b. rig better. Not true, is it George? Hope you are soon up and about again.

Heard Bob 7ZAA and Winston 7ZWN talking about firing up on 6 metres soon. Anyone else interested? Also heard on the grapevine that a well known Postina Ham is shifting to a new QTH at Devonport. Looks like another member for the N.W. Zone.

There was again an excellent attendance at our November meeting, there being 20 members present. We were pleased to see George 7XL there looking 100 per cent. fit again The main interest for the evening was an excellent talk by David 7MS, complete with block diagrams and tape recorded, on the latest in communications receiver design. David had a thorough knowledge of his subject, and proved this by presenting the "piece de resistance"—his 20-valve receiver which had taken him over a year to construct. It is a very professional looking job and even has motorised tuning to get from one end of the band to the other in a hurry. David even gave a working demonstration and it worked fine business.

We were also presented with a film display on a.c. and d.c. theory and another on oscillators which proved very popular with some of our newer members.

Winston 7ZWN managed to work Den 7DK in Launceston from Sisters Hills at 5 and 5-8 on his portable gear Nice work Winston. Bob 7ZAA has been attempting to bounce a signal off the satellite. Mike 7ZAV, Kevin and Winston have all been very active with v.h.f. mobile rigs, and good signals have been reported. Must be a sign of summer weather Our old friend Max 7MX is still touring New Zealand. Half his luck. We expect to see a "hucks" at the next meeting, Max.

That's all for now, chaps, see you at the Hamfest at Campbelltown. 73, Ken 7KH.

The W.I.A. has nearly 3,000 members. Wear the badge which proclaims **your** membership. You can buy it from your Divisional Secretary.

HAMADS

Minimum 5/-, for thirty words. Extra words, 2d. each.

Advertisements under this heading will be accepted only from Amateurs and S.w.l's. The Publishers reserve the right to reject any advertising which, in their opinion, is of a commercial nature. Copy must be received at P.O. Box 36, East Melbourne, C.2, Vic., by 8th of the month and remittance should accompany the advertisement.

FOR SALE: BC348 Receiver, speaker, A.c. Power Supply, Converted, Noise Limiter, S Meter, good order, £18. AR8 Receiver, A.c. Power Supply, Speaker, needs slight attention, £5. 35 Valley Pde., Glen Iris, Vic. Phone 29-7256.

FOR SALE: Collins 75A4 Rx with 6, 3.1 and 2.1 kc. Mech. Filters, £300. 32S1 Tx with A.c. Power Supply, £300. Both perfect condition. VK6RX, W. Clowes, 4 Nicholson Rd., Subiaco, W.A.

FOR SALE: E.I.L. Communications Receiver, HCR62, air tested, perfect condition, brand new, retail £75. Best offer. Write "Newsagency," Golden Square, Vic.

FOR SALE: Transmitter type AT14, complete with handbook and valves. 2 to 20 Mc., v.f.o. or crystal, £25. The power supply delivers 1,500v. at ½ amp. and 750v. at ½ amp. and appears to be worth the price by itself. Bob Boase, 50 Cardigan Street, Carlton, Vic. Phone Melbourne 34-9491.

HALLICRAFTERS HT32B Transmitter for sale. Mint condition, 10-80 metres coverage on s.s.b., a.m., c.w., 1 kc. accurate frequency read-out, high frequency hermetically sealed crystal sideband filter, 144 watts p.e.p. both sidebands on a.m. and s.s.b., 52 ohm pi-network output for harmonic suppression, logarithmic meter for precise tuning and carrier level adjustments, high stability de luxe construction, £425 or near offer. Hallicrafters SX115 triple conversion Receiver for sale, condition, 10-80 metres coverage on s.s.b., a.m., c.w., 1 kc. accuracy frequency read-out, product detector for s.s.b./c.w. envelope detector for a.m., separate noise limiters for a.m. and s.s.b./c.w., selectivity variable from 500 to 5,000 cycles, built-in 100 kc. crystal calibrator, sensitivity less 1 microvolt, S meter functions with a.v.c. off, £400 or near offer. H. Clem, VK4HC, 7 Molloy St., Silkstone, Ipswich, Qld. Phone 81-2360.

RECEIVER 1155 in rack, £30 or best offer. Tech TC2 Tube Tester, £10. G. Williamson, VK3GW, 62 French St., Lalor, Vic. Phone 46-6586.

SELL: Swan 120, 14-14350 kc., pwr. spy., mic., spk., see "A.R." Jan '63. AR7 Rec., good clean condition, £25. VK2WS.

SELL: Two Power Supply Units, 240v. a.c. input, 750v. at 230 mA. output, 12v. and 6v. fils., good regulation, £8 each. Other smaller units. No. 128 Transceiver, 2-4.5 Mc., less power supply, suit boat, car, £3/10/0. BC348 Communications Receiver, A1 order, some spares, £30. 1 mile 100 lb. copper soft wire (heavy gauge), ideal for rhombics, etc., £15. Also assortment Trannies, Chokes, d. spaced Tx condx, etc. VK4SS Al Shawsmith, 35 Whynot St., West End, Brisbane, Qld. Phone 4-6526 before 4 p.m.

SELL: 7 ft. Tx Rack, £5. Type 3 Mk. II., with modulator (no mike), £22½. No. 122 Set, £12½. HRO Receiver, bandspread coils, £40. CRO 1" tube, complete, £5. CRO, 2" tube, type 902, £2. Modulator, comprising zero bias 807s (no tubes), Woden mod. trans. (120w. audio), A & R input transformer, £8/10/0. Power Transformer, 1250, 750/750, 1250, 150 mA., and Choke, 150 mA., £5 pair. Power Transformer, A & R, 565, 425/425, 565, 250 mA., A & R Swinging Choke, 300 mA., £6 pair. Power Transformer, A & R, 400/400, 150 mA., A & R Choke, 200 mA., £4½ pair. Power Transformer, 385/385, 300 mA., Choke, 200 mA., £5 pair. Russell Bradshaw, VK3SX, Phone 82-2152 (Melbourne).

STEP-DOWN Transformer, 240v. to 115v., 5k.v.a., in original packing case, £25 collect. Dineen, VK3TD, Mt. Eliza, Vic. Phone 7-1407, or office 544-0361.

V.H.F. Sell-up.—Crystals, frequencies in kc.: 1600, 1605, 1650, 2505, 3535, 3655, 4360, 4980, 5000, 5475, 6005, 6250, 6275, 6300, 6312, 6440, 6825, 7010, 8000, 8010, 8190, 8230, 8371, 8498, 8790, 15110. Valves: 12AU7s, 12AT7s, 6AL5s, 6CQ6s, 6BX6s, 6CH6s, 6AM6s, 6BY7s, VR150s, also OA211s. New Electrolytics: 200 μF., 200 volt. All above items are 7/6 each or 3 for £1. Crystals: 40,000 kc., 42,444 kc. (50 Mc. i.f. on 432 Mc.) and 48,015 kc., all £1 each. Brand New Valves: QQE06/40 £4; TD03/10s £1; A2521s (out-performs the 417A on 432 Mc.) £1. Slightly Used Valves, all guaranteed: QQE06/40 £3; QQCO4/15 £1; QQE03/12 £1; 4/65A £3; also OC28s £3 a pair. I.F. Transformers: 50 kc., 85 kc., 100 kc., £1 a pair. Co-ax: RG8/U equivalent, 75 ft. lengths, £1; UR70, 75 ft. lengths, £1. Valve Sockets: QQE06/40 type 10/-; 4/125A, QB3/300 type 10/-; 9-pin and 7-pin P.T.F.E. 3/-; 9-pin ceramic 2/-. V.h.f. Trimmers: 0.5 to 4 pF. and 0.5 to 7 pF., 6d. each, 5/- a dozen. 25 pF. and 50 pF. 2/6 each. Postage 2/6 on every order. Be quick! A. C. Rechner, 13 Blamey Ave., Broadview, South Aust.

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INDEX TO VOLUME 32–1964

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